Bernhard Schimpelsberger

Matr.Nr: 04BU120

Advanced Indian Rhythm Studies for Western Musicians

A Guide through the Secret Rhythm Calculations

Master – Arbeit

Zur Erlangung des Akademischen Grades

Master of Arts

des Studiums KMA Master Instrumental Jazz und Improvisierte Musik Schlagwerk

an der

Anton Bruckner Privatuniversität

Linz

Betreut durch: Jeff Boudreaux

Stephan Maaß

Linz, am 10.1.2011

CONTENTS

Preface

For the last 10 years I have been sincerely devoted to the studies of Indian rhythm and music. Through my trips to India, as well as my continued studies here in Europe I have spent valuable time with my teacher tablamaster Pandit Suresh Talwalkar. In the year 2006 my teacher and mentor Trilok Gurtu gifted me a book with the title *"A New Approach to Tala Calculations"* by *Sangeetha Vidwan* (master of music) S. Rajagopala Iyer.[1] The book explains in great detail the mathematical structures that form the base of the Indian rhythm system. I was spellbound and took much hardship and time to work my way through it. It was somewhat of a hard task to fully comprehend it. Written and published first in 1988 solely for the Indian market it is filled with specific Indian music terminology and thus hard to access for any person from outside India. The book is no longer available on the market.

The aim of my work "Advanced Indian Rhythm Studies for Western Musicians - A Guide through the Secret Rhythm Calculations" is to process this wonderful material that I have learned from this book, my studies in India as well as the results of my own personal research. The aim is to recycle it, simplify it, and define it anew in a more open compound and therefore making it more accessible to the Western students as well.

Of course the structures and calculations are not new. On the contrary they are basic mathematical structures. They are traditional material and therefore very old.

What you find in this work is not a mere collection of mathematical statistics and formulas but an essay on how to look at rhythm from a mathematical perspective. Understanding the mathematics will help you to perceive rhythm as space.

To me rhythm is nothing else but architecture of space and time. Space and time which, can be arranged into exciting musical designs. This work shows ways and ideas on how to work with that space and become free. As muscicans and creative spirits gaining freedom is always one of the highest goals. Managing to perceive rhythm as space will bring you freedom of what to play and compose.

Stan Gudder a lecturing professor of mathematics at the university of Denver (USA) says *„The essence of mathematics is not to make simple things more complicated, but to make complicated things simple."* I hope this work will help to make you feel that way too.

[1] Iyer, S.Rajagopala. : Sangeetha Akshara Hridaya, A New Approach to Tala Calculations, Bangalore, 1988

Abbreviations used in this book:

A = J – G or J - I

DP = the double place

FB = Full beats

G = Gap

G = gap

I = Index

J = phrase (deriving from the Indian Sanskrut word *Jathi*)

MB = Micro beat

FB = Fill beat

OP = Original place

S = Speed

Signatory:

// TA = Sum or 1st beat of the cycle

/ = Dividing the rhythm into the full beat measures

T = First letter of J

Ta = First letter of gap

, = Micro beat rest

a = Filling letter of gap

T = Syllable Ta

k = Syllable ka or ki

t = Syllable te or ta

1. Indian Rhythm – A Brief Introduction

Tala and Sum

The Indian rhythmic tradition is arguably one of the most developed and sophisticated rhythmic traditions existing today. Developed as a part of the *Vedic* traditions[2] in the temples, its roots can be traced back to around 2000 years before Christ. Based on arithmetical mathematical calculations the Indian rhythmic system has developed its own science of rhythm. The system of *Tala* is a system of rhythmical cycles. There are 135 different *Talas* conceived, but less in use.

The first beat of the *Tala* is called the *Sum*. *Tala* is cyclic concept and therefore the *Sum* is the start and the end of the time cycle. The well-known musicologist Raghava R. Menon describes the *sum* in his book "Indian Music – The magic of the Raga" as *"..a tension develops till a point is reached where a climax explodes against the first beat.."*[3] Without a doubt the sum is a beat of highest importance. In India many rhythmical and melodic compositions lead to and resolve on the *sum*.

Tihai

The concept of Tihai is a predominant rhythmic structure in Indian rhythm. Any rhythm piece when repeated exactly three times is called a *Tihai*. A Tihai is typically used as a rhythmic cadence or serves as a demarcation to end a rhythmic thought resolving on the sum of the Tala. It can also be a concluding piece creating a transition to another section of the music. Tihais are based on arithmetic calculation and consist of fixed structures. They are fixed in nature but one is expected to master them until they become a part of a natural thought process.[4] There are two possible starting points of Tihais. A Tihai can start either on the *sum* of the time cycle or on any other random place in the middle of the time cycle. It is up to the performers choice. Fixed calculations for Tihais from *sum till sum* can be found in chapter 6.

[2] Jairazbhoy, N.A: The Rags of North Indian Music, Their Strcture & Evolution, Bombay, 1995 2nd Edition, Pg.16

[3] Menon, Raghava R.: Indian Music, The magic of the Raga, New Delhi, 1998, Pg. 59

[4] Gottlieb, Robert S.: Solo Tabla Drumming of North India, First Indian Edition: Delhi, 1993, Pg.44

Formulas starting from random places in the middle of the time cycle will be explained in the chapters 2, 3, 4 and 5.

Konnakol – the Indian rhythm language

In India the music education has always been an oral tradition. Contrary to the West where one consistent notation system or staff notation for music has evolved. Music was always been passed on directly from the teacher to the student, and therefore many specific languages and dialects of rhythm have been maintained. Originally they all served the purpose of memorizing rhythms. The rhythm language called *Konnakol* is predominant in the south of India[5] and offers an excellent system of singing rhythms in all tempos, as well as abbreviating them for quick notation. Every phrase expresses the length of a rhythmical cell and is shown in numbers. In this language a large repertoire of phrases can be created by the combination of syllables.

Before we talk about the rhythms that will be covered in this book we must agree on a system of notation. When looking at both Western and Indian notation one will agree that *Konnakol* is the by far a more suitable choice.

Here are some of the basic phrases that will be used as our repertoire:

1:Ta = shown as T

2:**T**aka = shown as **T**k

3:**T**akite = shown as **T**kt

4:**T**akadimi = shown as **T**kdm

5: **T**akaTakite or **T**adigenato = shown as **T**ktkt or **T**dgnt

6: **T**akite takite or **T**adi,genato = shown as **T**kt tkt or **T**d,gnt

7: **T**akadimi takite or **T**a,di,genato = shown as **T**kdm tkt or **T**,d,gnt

8: **T**akadimi takajuna or **T**akitedi ,genato = shown as **T**kdm tkjn or **T**ktd ,gnt

9: **T**akadimi takatakite or **T**a,di,ge,na,to = shown as **T**kdm tktkt or **T**,d,g,n,t

Not only the spoken phrases (J) are referred to as numbers, but also the gaps (G). The first letter of a gap (G) is always spoken[6], whereas the remaining micro beats (MBs) are silent and

[5] Subramaniam, L. : Euphony, Indian Classical Music, Madras, 1995, Pg. 18

[6] Haddad, Jamey: Article on Indian Rhythm, Modern Drummer Magazine, Edition Nr.1, 1986

shown with commas. Once the gaps become larger, filling letters are introduced to maintain the musical flow of the pattern.

The gaps (G) are shown as:

1 = Ta

2 = Ta,

3 = Ta,,

4 = Ta,,,

5 = Ta,a,,

6 = Ta,,a,,

7 = Ta,a,a ,,

The Place (P) – a starting point

The Place is the starting point of a particular rhythmical phrase. It is labeld by its distance to the 1st beat (*Sum*) of the next rhythmical cycle. There are different types of places (P). For most constellations in this book we will use a place referred to as the original place (OP). A place is called the original place (OP), when the phrase (J) given and the place (P) are equal.[7] The place (P) is defined by counting backwards from the *Sum,* which is the target point of the rhythmical resolution. This is contrary to the Western approach where rhythms are counted forwards from a starting point and not backwards to a resolving point. This practice resembles the cyclic nature of Indian rhythms.

Example:

The chosen time cycle is 8 beats. The starting *Sum* itself is the 8th place since the distance to the next *Sum* is 8 beats. Beat number 2 is the 7th place, 7 beats away from the next *Sum*. Beat Number 3 is the 6th place, 6 beats away from the *Sum*. And so forth.

An 8 beat cycle therefore looks like this:

Beat:	1	2	3	4	5	6	7	8	*Sum*
Place:	8th	7th	6th	5th	4th	3rd	2nd	1st	

[7] Iyer, S.Rajagopala. : Sangeetha Akshara Hridaya, A New Approach to Tala Calculations, Bangalore, 1988, Pg. 15

The label of the place, (for example 5th place or 7th place) defines the distance that will be covered till the *Sum*. Depending on the time cycle the distance between the starting *Sum* and starting place (P) can vary. The space that needs to be covered to reach the place (P) is called the Index (I). When subtracting the place (P) from the time cycle the length of the Index is defined.

Here some examples:

Time cycle (or multiple of it)	Place (P)	Index (I) = time cycle – place (P)
8	5	3
8	3	5
7	5	2
7	4	3
6	3	3
6	4	2
9	6	3
9	7	2

Speeds (S)

Once the place (P) is fixed the number of full beats (FB) from the place (P) to the *sum* is fixed. But the number of available micro beats (MB) is still variable.

The speed (S) defines the number of micro beats that fit into one full beat.

Here are the most common *speeds* (S) in use:

- Crotchets = 1 micro beat per full beat, shown as S_1
- Quavers = 2 micro beats per full beat, shown as S_2
- Quaver Triplets = 3 micro beats per full beat, shown as S_3
- Semi Quavers = 4 micro beats per full beat, shown as S_4
- Quintuplets = 5 micro beats per full beat, shown as S_5
- Semiquaver Triplets = 6 micro beats per full beat, shown as S_6
- Seventuplets = 7 micro beats per full beat, shown as S_7
- Demisemi Quavers = 8 micro beats per full beat, shown as S_8

Multiplying the Place (P) with the speed (S) defines the exact number of micro beats that can be given from the place (P) to the sum.

2. Adding various values to a phrase

2.1. Variations and Combinations

The first chapter of this book will look at the possibilities that can be created by extending a phrase (J). Taking a simple phrase (J) as the base, values can be added to the same to change its length and spacing.

Let us look at this in detail. For the first example we will choose S_4 as the basic speed with 4 micro beats per full beat (FB) and the 5th place as the starting point. The 5th place comprising 5 full beats (FBs) is multiplied by 4 micro beats (MBs) and therefore makes a total of 20 micro beats (MBs). These micro beats (MBs) can be arranged into various musical phrases. For this example we choose the number 5 for our basic phrase J since we are starting from the 5th place. Note that this is a musical choice and J could be assigned other numbers as well.

In the first case no additional value is assigned to the phrase (J). Every letter (**T**ktkt) is equal to 1 micro beat (MB).

- Phrase (J) 5: 1 micro beat per letter (= 1 MB letter + 0 MB rest) total length: 5 micro beats (MB), shown as 5;

From the 5th place the phrase (J) can be given 4x as:

- 5 5 5 5 or spoken as: **T**ktk / t**T**kt / kt**T**k / tkt**T** / ktkt // Ta

Now we create the next higher value of the phrase (J) by inserting 1 MB after each letter. The phrase (J) becomes twice as long.

- Phrase (J) 5_2: 2 micro beats per letter (= 1 MB letter + 1 MB rest) total length: 10 micro beats (MB), shown as 5_2;

Each phrase (J) has now the length of 10 micro beats (MB) and can be given only 2x from the 5th place (as opposed to 4x in the previous example):

- $5_2\ 5_2$ spoken as: **T**,k, / t,k, / t,**T**, / k,t, / k,t, // Ta

Of course the two values of 5 and 5_2 can also be combined[8]:

- $5_2\ 5\ 5$ spoken as: **T**,k, / t,k, / t,**T**k / tkt **T** / ktkt // Ta

or

- $5\ 5\ 5_2$ spoken as: **T**ktk / t**T**kt / kt**T**, / k,t, / k,t, // Ta

or in a more complex version:

- $5\ 5_2\ 5$ spoken as: **T**ktk / t**T**,k /,t,k / ,t,**T** / ktkt // Ta

To create the next higher value another 1 micro beat gap is added after each letter, creating a value of 3. The original starting phrase of 5 has now expanded into 5_3 with a total length of 15 micro beats (MBs).

- Phrase (J) 5_3: 3 micro beats per letter (= 1 MB letter + 2 MB rests) total length: 15 MB, shown as 5_3;

From the 5th Place it can be given as:

- $5\ 5_3$ spoken as: **T**ktk / t**T**,, / k,,t / ,,k, / ,t,, // Ta

or as

- $5_3\ 5$ spoken as: **T**,,k / ,,t, / ,k,, / t,,**T** / ktkt // Ta

We continue to expand our Phrase (J) with gaps. The next value is J_4.

- Phrase (J) 5_4: 4 micro beats per letter (= 1 MB letter + 3 MB rests) total length: 20 MB, shown as 5_4;

This variation is straightforward:

[8] Iyer, S.Rajagopala. : Sangeetha Akshara Hridaya, A New Approach to Tala Calculations, Bangalore, 1988, Pg. 25

- 5_4 spoken as: **T**,,, / k,,, / t,,, / k,,, / t,,, // Ta

The total number of values from the original place (OP) at S_4 (Semi Quaver speed) is 4.
With only 20 MBs to fill up we have reached the potential limit of this line.
To create more variations we need to expand the place (P).

After reaching the limitations from the original place (OP) the next step is to expand the place (P) to the double place. The double place is simply 2x the original place (OP).
The 5th place used in the previous example therefore becomes the 10th place. Starting from the double place (DP) also the number of micro beats (MB) doubles.
Besides knowing the exact number of micro beats (MBs) it is also important to know the exact number of values of the phrase (J) that can be fit from the place (P).
From the original place (OP) 4 values can be accommodated. From the double place (DP) it is therefore 8. With 40 micro beats (MBs`) at hand many more new variations can be created.
Let us look at some permutations and combinations of the values J, J_2, J_3 and J_4 comprising of 8 values:

- $5\ 5\ 5_2\ 5\ 5_2\ 5$
- $5\ 5_2\ 5\ 5\ 5_3$
- $5\ 5_4\ 5_3$
- $5\ 5_4\ 5_2\ 5$
- $5_3\ 5_2\ 5_2\ 5$
- $5\ 5_2\ 5_3\ 5\ 5$

This is just a sample of many more possible permutations.
An extended chart with more variations can be found at the end of this chapter.

The next phrase we will introduce is 5_5. When the phrases are getting bigger, while the numbers of letters remain the same, it is necessary to add filling letters to the phrase (J). This is to maintain a balance between letters and rests within the pattern.

- Phrase (J) 5_5: 5 micro beats per letter (= 1 MB letter + 1 MB filling letter + 3 MB rests) total length: 25 MB, shown as 5_5;

The phrase (J) 5_5 is expanded with 1 more MB gap and is then divided into 2 + 3.

- 5_5 is spoken as: **T**, a,, k, a,, t, a,, k, i,, t, e,,

Here some possible variations from the double place (DP) using 5_5:

- $5_3\ 5_5$ spoken as:

T,,k / ,,t, / ,k,, / t,,**T** /,a,, / k,a, / ,t,a / ,,k, / i,,t / ,e,, // Ta

- $5\ 5_2\ 5_5$ spoken as:

Tktk / t**T**,k / ,t,k / ,t,**T** / ,a,, / k,a, / ,t,a / ,,k, / i,,t /,e,, // Ta

- $5_5\ 5_2\ 5$ spoken as:

T,a, / ,k,a / ,,t, / a,,k / ,i,, / t,e, / ,**T**, k / ,t, k / ,t,T / ktkt // Ta

Following the same principle of adding rests to the phrase (J) it can be extended to literally any desired rhythmical length. Aesthetically it only has to be considered that the bigger the phrase (J) gets the more filling letters have to be inserted.
We continue with 2 more Phrases:

- Phrase (J) 5_6: 6 micro beats per letter (= 1 MB letter + 1 MB filling letter + 4 MB rests) Total length: 30 MB, shown as 5_6;

6 is subdivided into 3 + 3.

- 5_6 is spoken as: **T**,, a,, k,, a,, t,, a,, k,, i,, t,, e,,

And:

- Phrase (J) 5_7: 7 micro beats per letter (= 1 MB letter + 2 MB filling letters + 4 MB rests) total length: 35 MB, shown as 5_7;

7 is subdivided as 2 + 2 + 3.

- 5_7 is spoken as: **T**, a, a,, k, a, a,, t, a, a,, k, i, i,, t, e, e,,

Below some possible combinations:

- 5 5_6 5 spoken as:

Tktk / t**T**,, / a,,k / ,,a, / ,t,, / a,,k / ,,i, / ,t,, / e,,**T** / ktkt // Ta

- 5 5_7 spoken as:

Tktk / t**T**, a / ,a,, / k, a, / a,,t / ,a,a / ,,k, / i,i, / ,t,e / ,e,, // Ta

- 5_7 5 spoken as:

T,a, / a,,k / ,a,a / ,,t, / a,a, / ,k,i / ,i,, / t,e, / e,,**T** / ktkt // Ta

We have seen that even when sticking to such a simple phrase like 5 (**T**ktkt) numerous variations can be created. Just imagine the possibilities when you start mixing phrases. The same principle used above can be applied to any other phrase.

Below is a summary of the phrases (J) that can be created by adding various values to a simple phrase (J):

- J: 1 micro beat per letter, (= 1 MB letter + 0 MB rests) total length: 1x J;
- J_2: 2 micro beats per letter (= 1 MB letter +1 MB rest) total length: 2x J;
- J_3: 3 micro beats per letter (= 1 MB letter + 2 MB rests) total length: 3x J;
- J_4: 4 micro beats per letter (= 1 MB letter + 3 MB rests) total length: 4x J;
- J_5: 5 micro beats per letter (= 1 MB letter + 1 MB filling letter + 3 MB rests) total length: 5x J;
- J_6: 6 micro beats per letter (= 1 MB letter + 1 MB filling letter + 4 MB rests) total length: 6x J;
- J_7: 7 micro beats per letter (= 1 MB letter + 2 MB filling letter + 4 MB rests) total length: 7x J;

The above examples have demonstrated the possibilities starting from the original place (OP) and from the double place (DP).
Below is a chart that shows the number of values for 8 Speeds (S):

Number of Values from the original Place (OP):

Speed (S)	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8
Number of Values:	1	2	3	4	5	6	7	8

Number of Values from the double Place (DP):

Speed (S)	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8
Number of Values:	2	4	6	8	10	12	14	16

Below a table with more variations with J, J_2, J_3 & J_4 from the double place (DT):

J J J_2 J_2 J J	J J J_2 J J_2 J	J J J_2 J J_3
J J J_2 J_3 J	J_2 J J J J_3	J_2 J J J_3 J
J J_2 J J J_3	J J_2 J J_3 J	J J_3 J J J_2
J J_3 J_2 J J	J J_3 J J_2 J	J J J_2 J_4
J_2 J J J_4	J J_2 J J_4	J J_3 J_4
J_4 J J_2 J	J_4 J_2 J J	J_4 J J J_2
J_4 J J_3	J_4 J_3 J	J J_2 J_3 J J
J J_2 J_3 J_2	J J_2 J_2 J_3	J J_3 J_2 J J
J J_4 J_3	J J_3 J_4	J_4 J_3 J
J_2 J_4 J_2	J J_3 J_3 J	J_3 J_2 J_3
J J_4 J_2 J	J_3 J_4 J	J_2 J_3 J_2 J