

## Analyzing same *svara* sequences in different *rāga*-s

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### Introduction

In the current *Karṇāṭaka* music system, *rāga*-s are organized within the framework of *janaka mēla*-s in terms of the *ārōhaṇa* and *avarōhaṇa*. While this approach is seemingly methodical, it inevitably runs into practical problems as it cannot fully describe the phenomenon of the *rāga*. The approach therefore needs to be reformed. The scope of this presentation however is limited to making observations and raising fundamental questions as a step towards reconstructing a new approach to understanding and organizing the *rāga*-s.

Analyzing the same sequence of *svara*-s across *rāga*-s is one way to uncover the discrepancies. By ‘sequence’ is meant not only the order of the *svara*-s but also the same-name *svara*-s. And by *svara* is meant the syllable and not the actual pitch profile. Typical examples will be presented using PRAAT, a pitch analysis software tool tested and trusted in the academia. The graphic displays clearly depict the pitch positioning of the individual *svara*-s. Contributing factors such as the strength of the *svara* and the *gamaka* may provide additional information. The mental process of *rāga* production and perception plays a vital role in establishing the musical context enabling us to differentiate the *rāga*-s despite employing the same sequence of *svara*-s.

Additionally, it can also be shown using the *Gayaka* program of the *Rasika* software how the same sequence of *svara*-s actually differ in their construction and nuances. This software has been developed by M. Subramanian which allows you to generate precise *gamaka*-s in tones of *vīṇā* and flute, by entering the *svara*-s along with their durations and transitions. The pitch movements of the *svara*-s can be reconfirmed by this software. We can decipher the differences clearly and better understand the *rāga*-s.

### Visual Depictions & Observations

In this section several sets of the same sequence of *svara*-s will be visually depicted and compared. The data and observations presented are limited to the material analyzed in this paper. And as the sub-head suggests, the depictions are visual without the quantification of the pitch values in terms of the average, minimum, maximum and the range. A statistical analysis is not required either because only the graphic movement is relevant to the current discussion.

The audio analyzed in this presentation has been rendered by me using the minidisk digital recorder and a condenser microphone. I sang verbalizing the *svara*-s.

The first set of *rāga*-s is *Ārabhi* and *Sāma*. The *avarōhaṇa* sequence, *Dha Pa Ma Ga Ri Sa* is same in both the *rāga*-s. Figure 1 shows the sequence in *Ārabhi* and Figure 2 shows the sequence in *Sāma*.

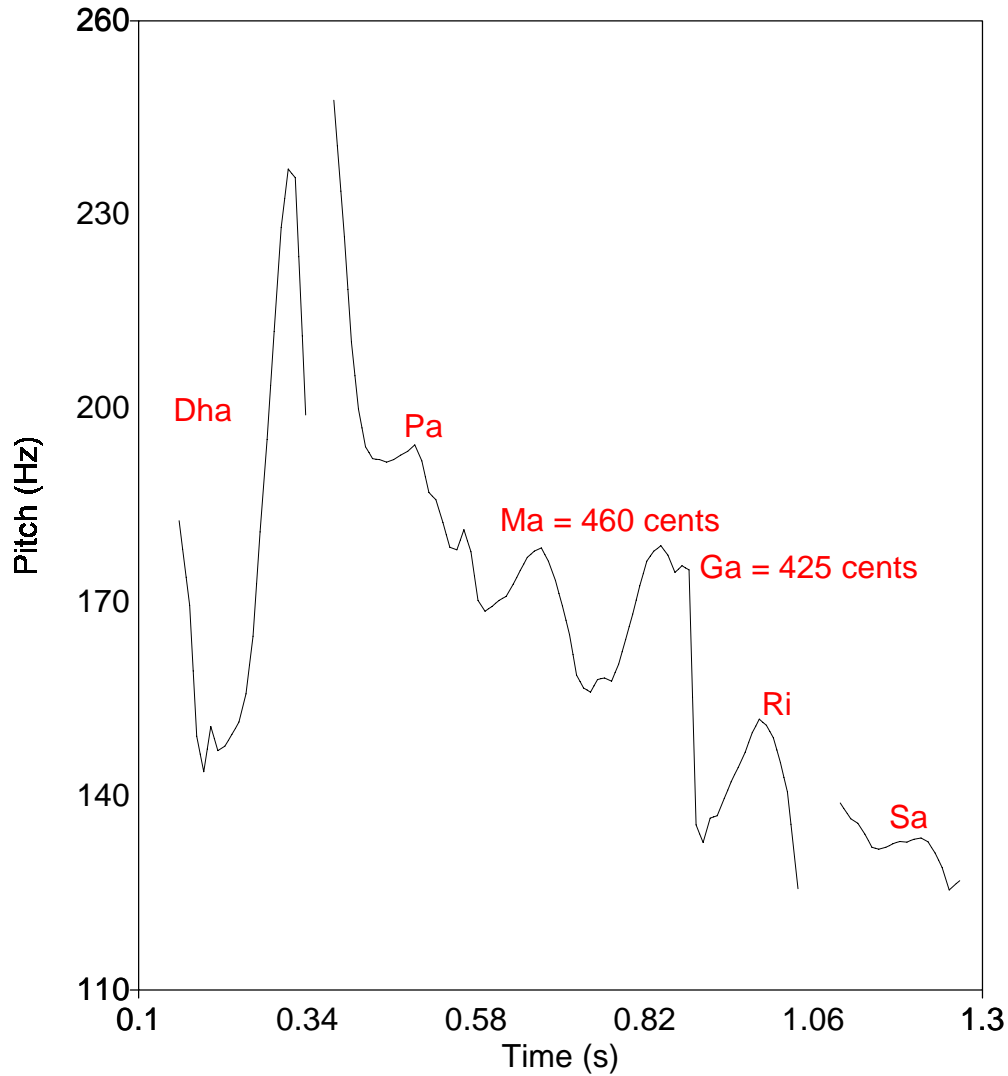


Figure 1: *Ārabhi* - *Dha Pa Ma Ga Ri Sa*

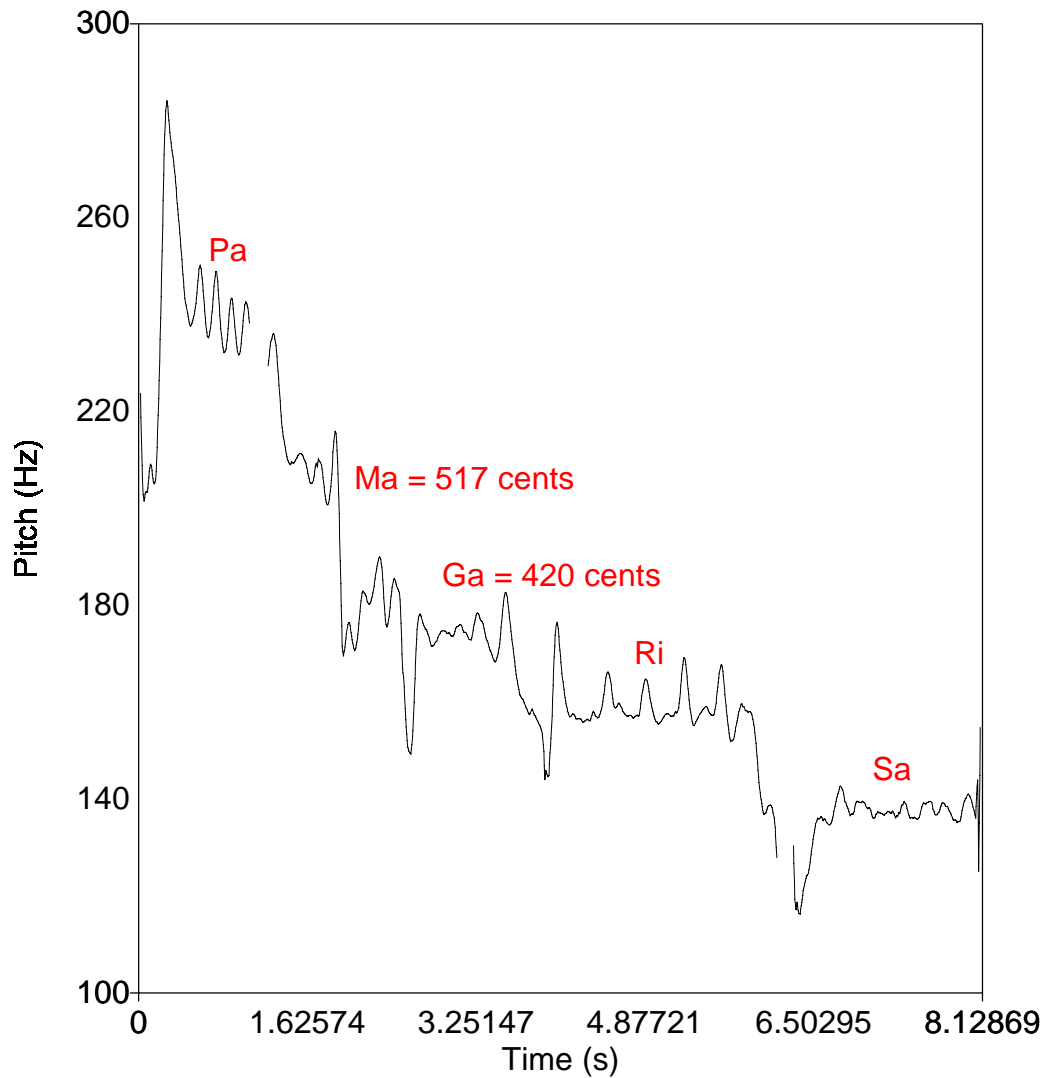


Figure 2: *Sāma - Dha Pa Ma Ga Ri Sa*

Observations pertaining to *Ārabhi* and *Sāma*:

1. It is clear that the pitching of *gāndhāra* with respect to the *madhyama* in *Ārabhi* is significantly different from *Sāma*. The difference of 35 cents between *Ma* and *Ga* in *Ārabhi* is smaller than the corresponding difference of 97 cents in *Sāma*. Of course, this is just one example and there will be several other possibilities. Note that all the cent values in this paper are rounded off.
2. The *gāndhāra* in *Ārabhi* is *alpa* (weak) and necessarily of short duration whereas it is pronounced and can be elongated in *Sāma*.
3. Incidentally in this case, the *ṛṣabha* in *Sāma* is higher than in *Ārabhi*.

The next set of *rāga*-s is *Ārabhi* and *Dēvagāndhārī*. The *svara* sequence, *Pa Ma Ga Ri Sa* is the same. Figure 3 shows the *Dēvagāndhārī avarōhaṇa* sequence.

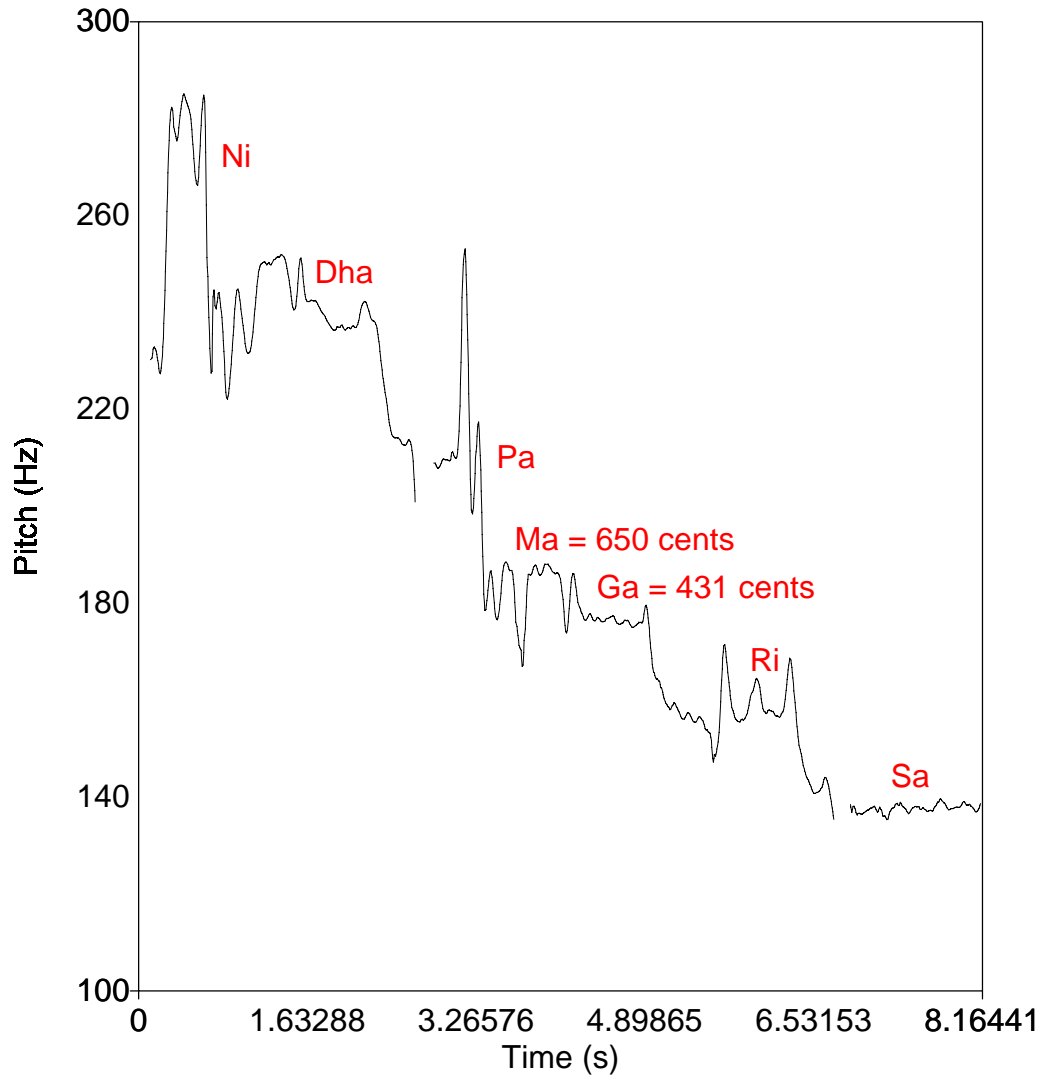


Figure 3: *Dēvagāndhārī- Śa Ni Dha Pa Ma Ga Ri Sa*

Observations pertaining to *Ārabhi* and *Dēvagāndhārī*.

1. The upper *Sa* and *Ni* are almost the same in *Dēvagāndhārī* and *Dha* spans to include *kaiśika niṣāda* distinctly. This in fact is a distinguishing feature of this *rāga*.
2. *Pa* tends towards *Ni* momentarily, crossing *Dha*. *Ma* is high in this case, close to *Pa* at 650 cents. *Ga* is also high at 431 cents; it is elongated and is taken from *Ma* and tends towards *Ri*. *Ri* is also higher at 240 cents.
3. In this case, the difference between *Ma* and *Ga* does not matter due to such a large movement.

4. The *svara*-s in *Dēvagāndhārī* are more fluid compared to the other two allied *rāga*-s; *Ārabhi* and *Sāma*. There are of course several other allied *rāga*-s such as *Pratāpavarālī* and *Naṭanārāyaṇī*.

Even unrelated *rāga*-s such as *Bilahari* and *Ārabhi* can have the same *avarōhaṇa* [*Śa Ni Dha Pa Ma Ga Ri Sa*]. Figure 4 shows the *avarōhaṇa* of *Bilahari*.

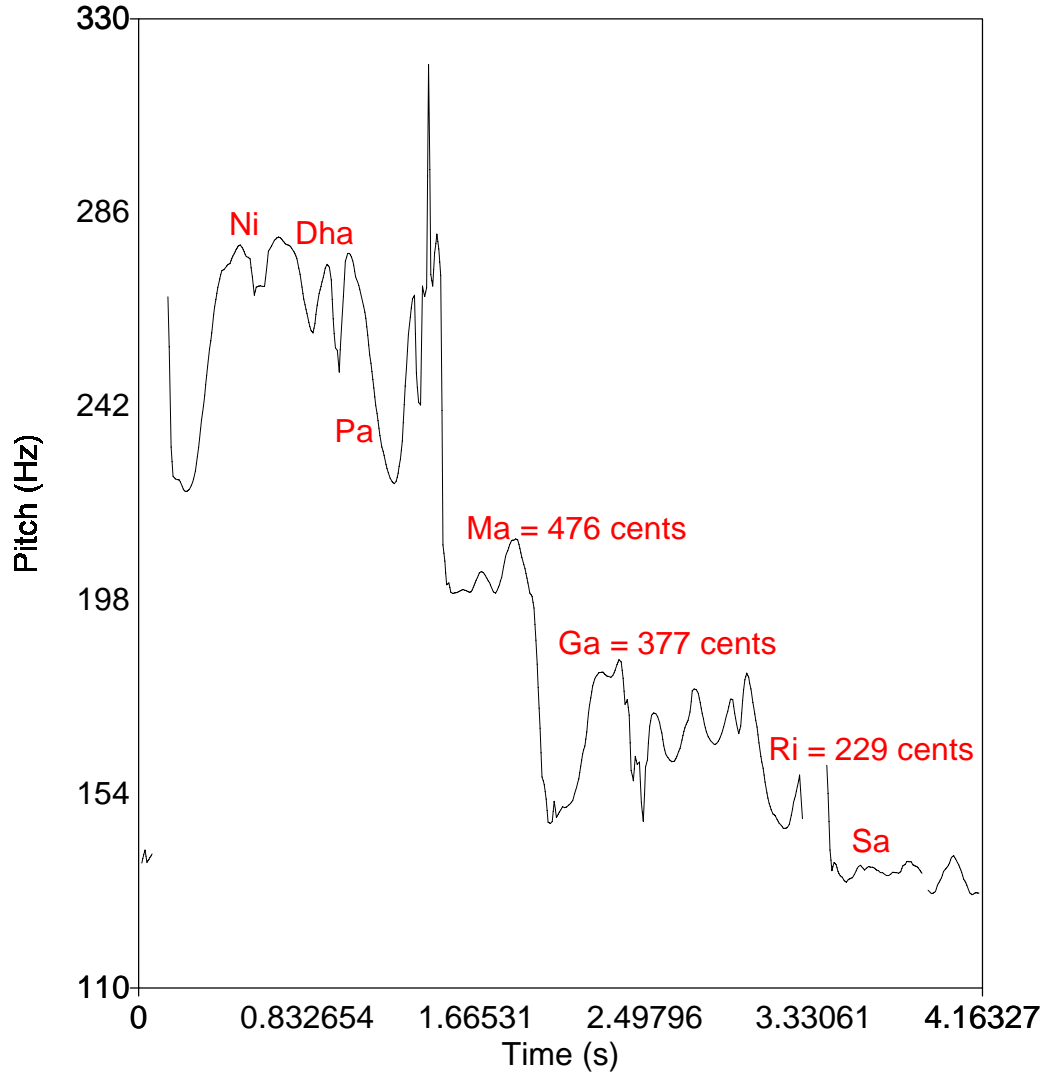


Figure 4: *Bilahari* - *Śa Ni Dha Pa Ma Ga Ri Sa*

Observations pertaining to *Ārabhi* and *Bilahari*:

1. Upper *Sa* typically starts at a lower point and *Ni* tends towards the upper *Sa* in *Bilahari*. *Dha* touched the upper *Sa* before coming down to 897 cents. *Ma* is taken from *Ga* and reached 476 cents. *Ga* is 377 cents and *Ri* is 229 cents. The difference between *Ma* and *Ga* is 99 cents.
2. Comparing the above four *rāga*-s, the difference between *Ma* and *Ga* is the least in *Ārabhi*. Of course, more samples need to be studied to determine the pitch profiles more realistically but as stated, in this presentation, the focus is only on the demonstration of the fact that the same sequence of *svara*-s across allied and unrelated *rāga*-s vary significantly and therefore defies defining the *rāga* merely in terms of the *svara*-sequences.

Yet another set of *rāga*-s is *Bhairavī* and *Mukhārī*. Figure 5 depicts the *avarōhaṇa* of *Bhairavī*. Figure 6 illustrates the same for *Mukhārī*. The other *rāga*-s allied are *Ānandabhairavī*, *Husēnī* and *Rītigaula*.

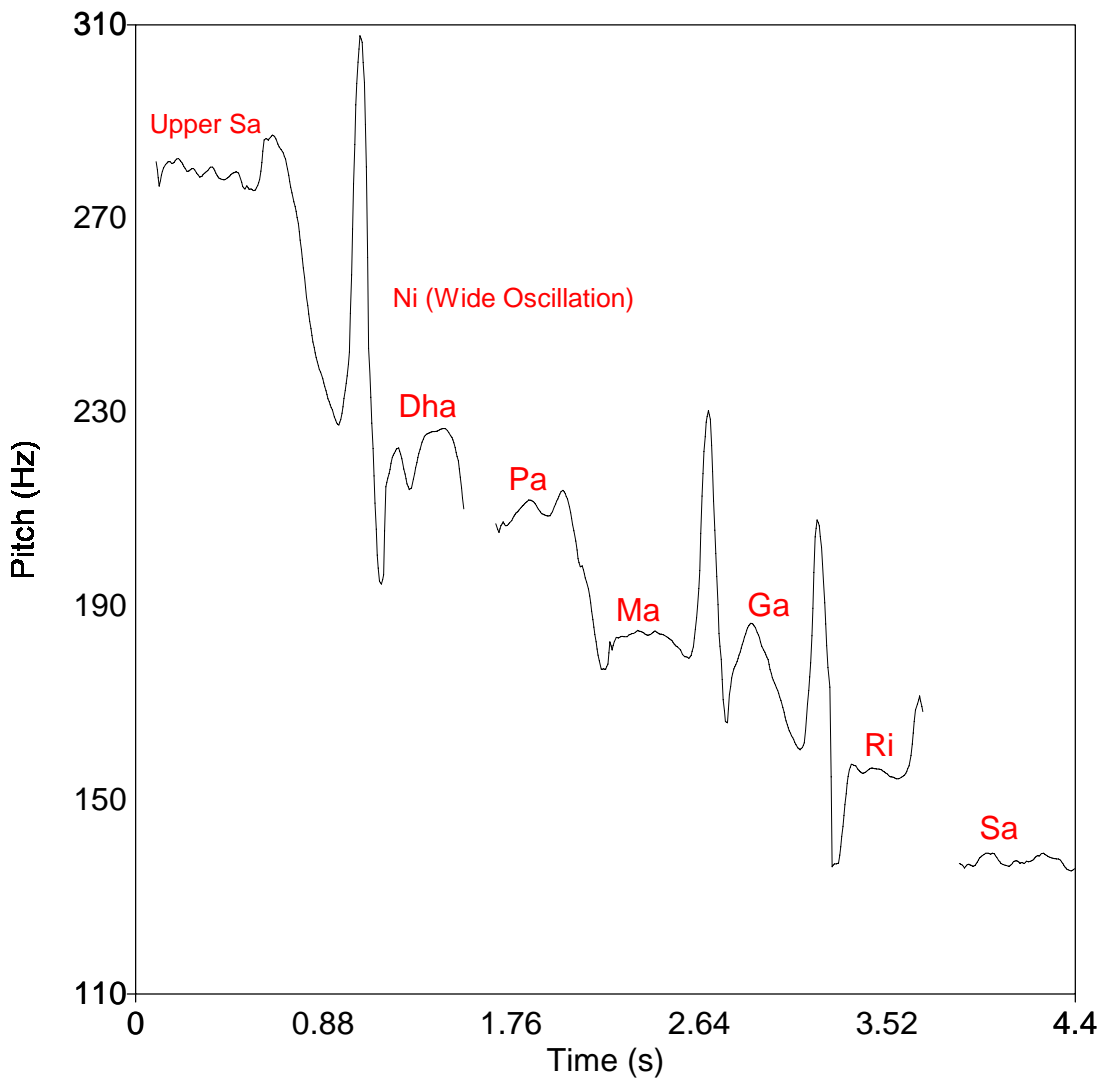


Figure 5: *Bhairavī*- Śa Ni Dha Pa Ma Ga Ri Sa

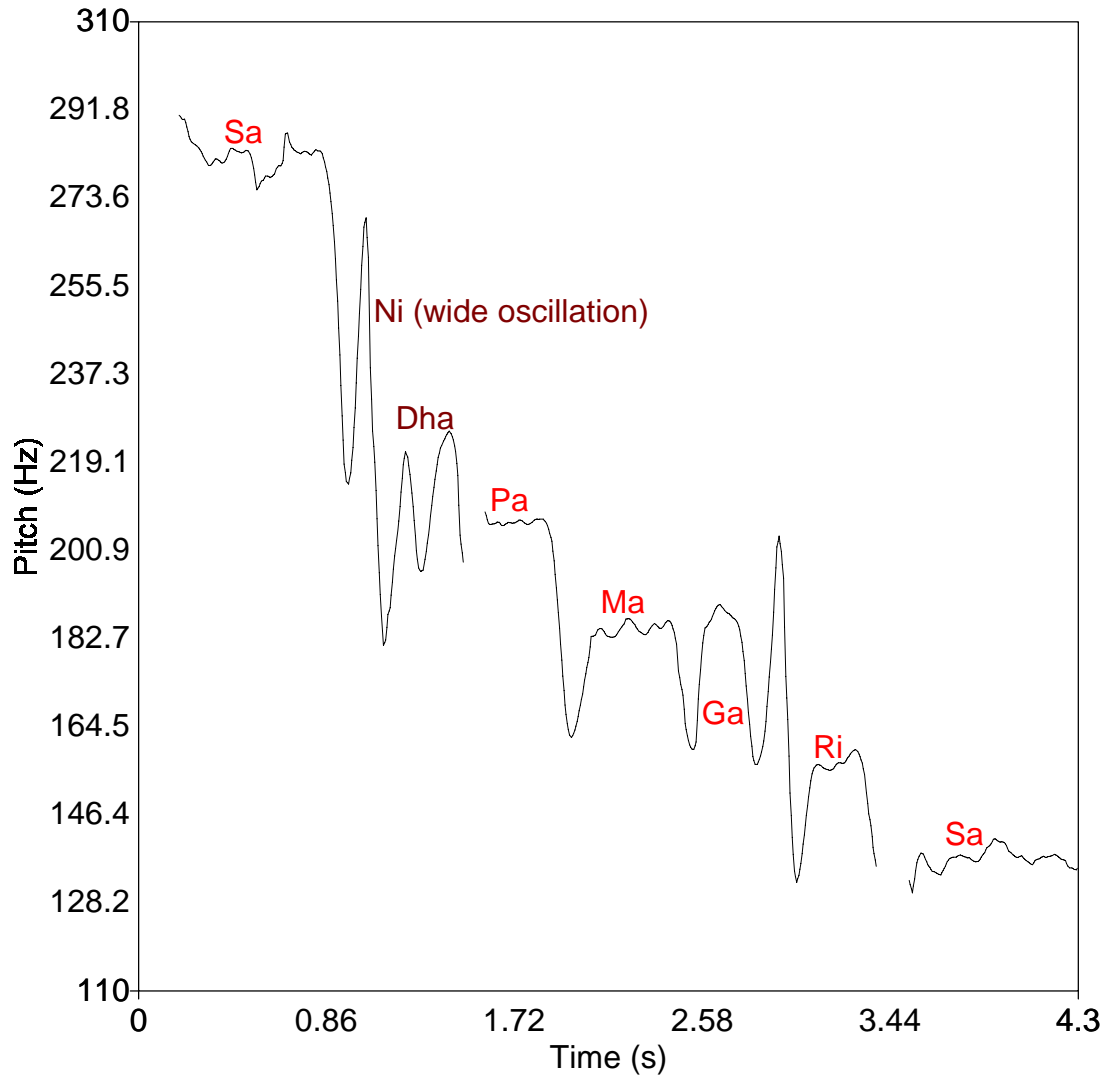


Figure 6: *Mukhārī*- Śa Ni Dha Pa Ma Ga Ri Sa

Observations pertaining to *Bhairavī* and *Mukhārī*.

1. In *Bhairavī* and *Mukhārī*, *Ni* oscillates significantly as shown; it does not have a resting place. And, *Dha* is very fluid.
2. Although *Ga* oscillates between *Ma* & *Ri*, there is a perception of an average which seems like *Ga*.
3. The *avarōhaṇa* [Śa Ni Dha Pa Ma Ga Ri Sa] is perceived as almost the same in both these *rāga*-s aurally. But visually, the subtle differences are apparent.
4. The shake on *Ni* in *Bhairavī* is larger and crosses the upper *Sa* momentarily.

Another set of *rāga*-s could be *Madhyamāvātī*, *Śrī* and *Bṛndāvanī*. This time, let us consider the *ārōhaṇa* [Sa Ri Ma Pa Ni Śa] which is practically the same. Additionally, it may be noted here that *Puṣpalatikā*, *Pūrṇaṣaḍjam*, *Mañirāngu* and *Rudrapriyā* are some of the allied *rāga*-s. Figure 7 shows the *ārōhaṇa* of *Madhyamāvātī*; Figure 8 shows *Śrī* and Figure 9 shows *Bṛndāvanī*.

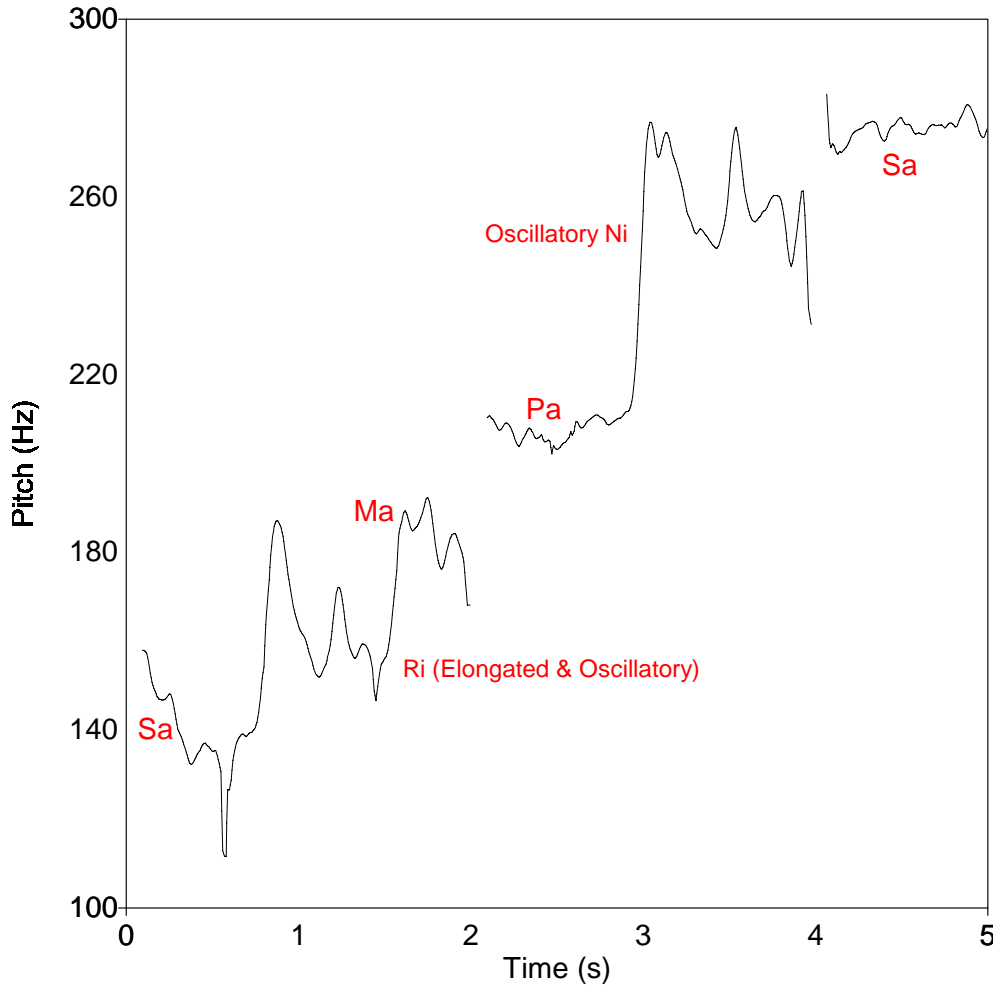


Figure 7: *Madhyamāvātī* - Sa Ri Ma Pa Ni Śa

Observations pertaining to *Madhyamāvātī*, *Śrī* and *Bṛndāvanī*:

1. In these three *rāga*-s the average pitch values of the *svara*-s are almost the same (close to the natural harmonic values) but the profiling is distinct.
2. The *svara*-s *Ri* and *Ni* in *Madhyamāvātī* oscillate significantly as shown.
3. The *svara*-s of *Śrī* and *Madhyamāvātī* are almost the same; the treatment of the *svara*-s (in terms of the stress and duration) differs as shown visually. *Ri* in *Śrī* *rāga* does not have the kind of



shake that *Madhyamāvātī Ri* has. *Ni* is shorter in *Śrī rāga* compared to *Madhyamāvātī Ni* and goes up to the upper *Sa* before coming down. And, it is lighter without too much *gamaka*.

4. The main difference between *Madhyamāvātī* and *Śrī rāga*-s is the *avarōhaṇa*.
5. In *Bṛndāvanī*, each of the *svara*-s *Ri*, *Ma*, *Pa* and *Ni* tend towards their next higher *svara* as shown in Figure 9. This is one of the distinguishing features of *Bṛndāvanī*. But the real distinction comes in the *avarōhaṇa* in the way the descending *Ni* is negotiated uniquely.

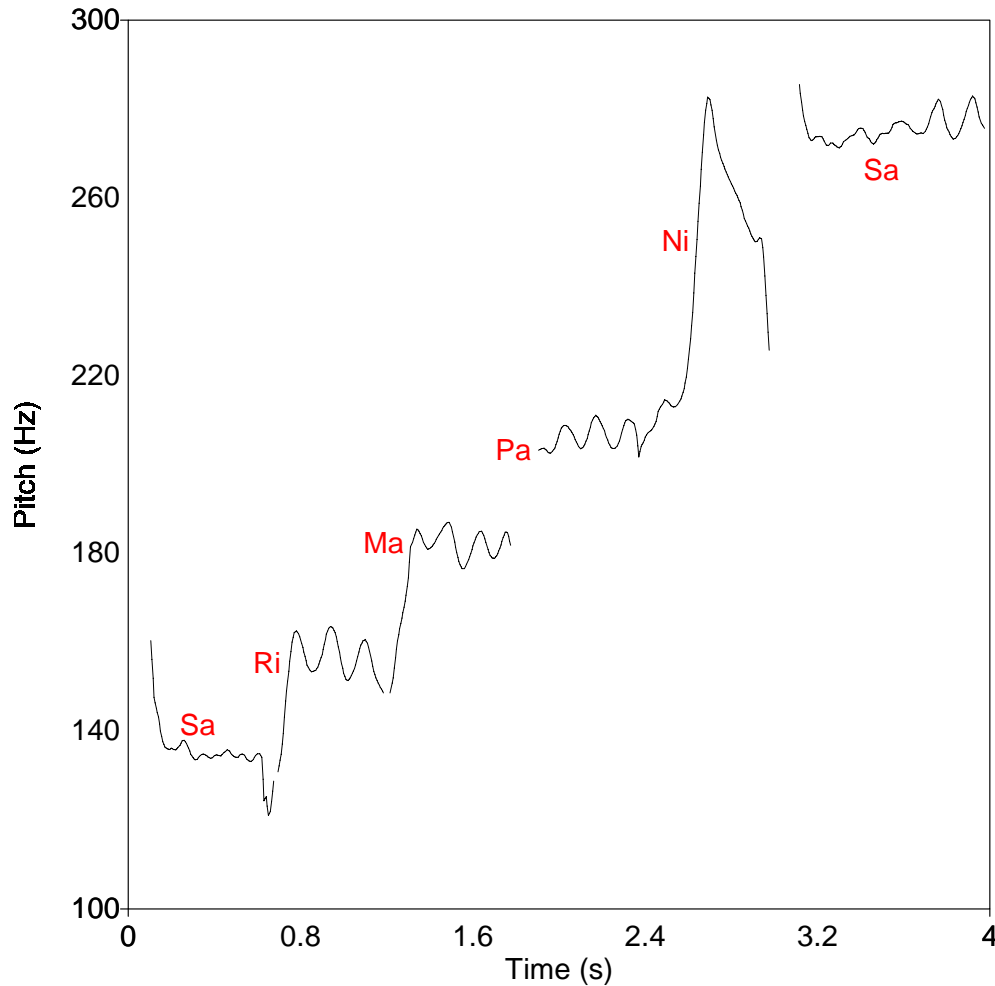


Figure 8: *Śrī- Sa Ri Ma Pa Ni Śa*

There can be many more examples such as the *ārōhaṇa* of *Kedāragaula* & *Suraṭī* [*Ga* is weak] and of *Mōhana* and *Bilahari* being the same and likewise, *Mukhārī* and *Maṇiraṅgu* having the same *Pa Ma Ga Ri Sa* sequence and so on.

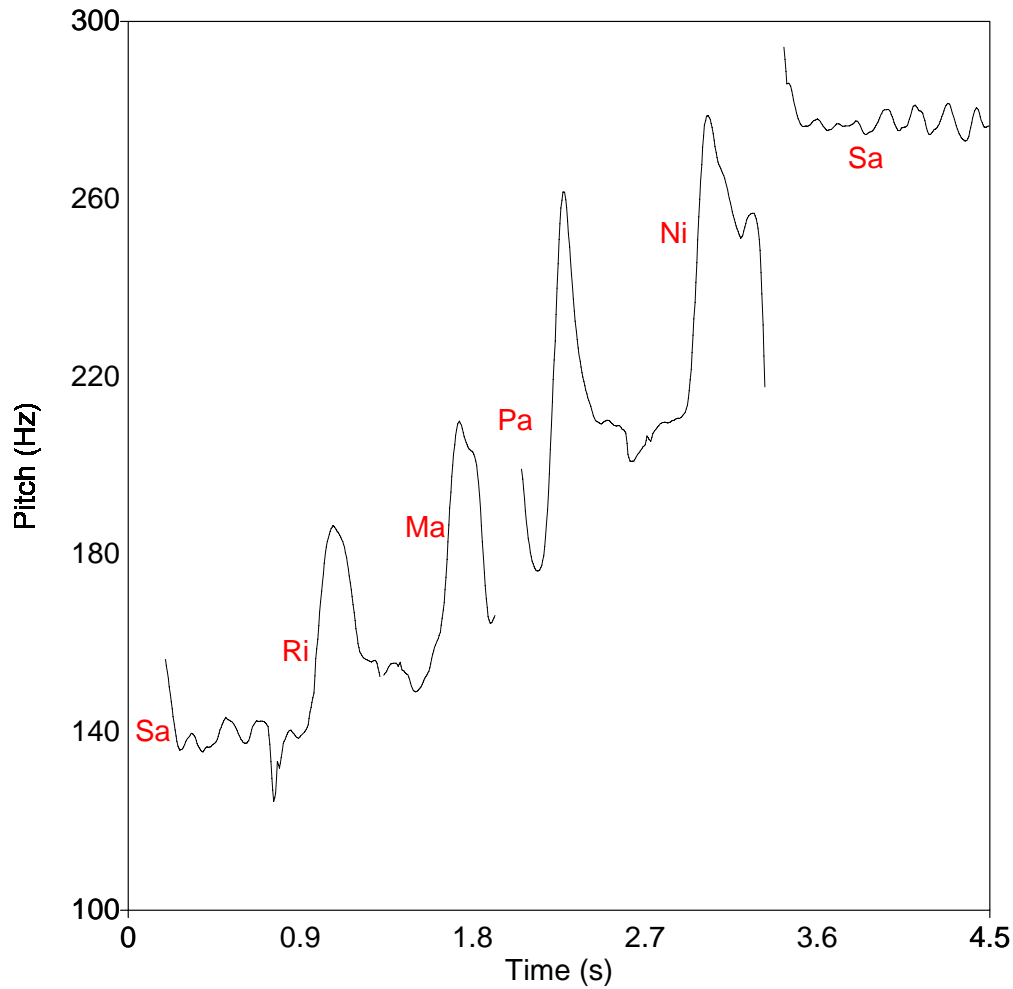


Figure 9: *Bṛndāvanī*- Sa Ri Ma Pa Ni Śa

## Analysis and Discussion

The above visual depictions and observations clearly show the differences in the manifestation of the same sequence of *svara*-s. Just as *svara* is a simplified code for communication, a phrase expressed in terms of *svara*-s is also a simplistic form of communication. Despite the scale-centric approach to organizing the *rāga*-s, many *rāga*-s such as *Aṭhāṇā* continue to defy such definition. The same sequence of *svara*-s behaves differently in different *rāga*-s. In other words, sequence of *svara*-s alone is incomplete in portraying a *rāga*. The evidence presented in this paper lays bare this fact. Therefore the current paradigm of *svara*-based conceptualization of the *rāga*-s is incomplete and at times even incorrect. Any model that fails to explain a phenomenon fully should be revised or replaced by another more comprehensive model based on further observations and newer findings as illustrated in this presentation.

Attributes, nuances and the contextual meaning of phrases are more complex than *svara*-s and *svara*-sequences can capture or deliver. Nonetheless, *svara*-s and *svara*-sequences with the standard pitch values derived from the natural harmonic series do provide the reference for measurement, communication and the development of software such as the *Rasika*.

Further, once the *rāga* is established, the same sequence of *svara*-s will be perceived differently across *rāga*-s. Such neurological imaging is yet to be fully deciphered. The distinct *raga* identity comes about because of the several characteristic *prayōga*-s that create such neurological imaging. It has been established that the tonotopic pitch maps in the primary auditory cortex physically alter and firm up upon deliberate learning [Komaragiri, 2005]. The production and perception are then guided by such stored pitch maps.

Some questions are pertinent to this discussion:

With the availability of the graphic displays such as those presented here, can the *svara*-sequence across different *rāga*-s be differentiated visually? That is, discarding the entity of *svara*, is it possible to retrain the brain to recognize the distinctions among *svara*-sequences visually? This question is not far-fetched because many musicians, me included, actually conceive *rāga*-s based on such mental imagery. Sans attributes, what role does *svara* and scale play in actualizing the *rāga* music? Does scale exist because of the *rāga* or do *rāga*-s exist because of the scales? Also, when there is an oscillation from say, *Ri* to *Ma* as in *Bhairavī*, giving the illusion of *Ga*, does the brain average such oscillations? And if so, is it contextual? Is it with reference to the pitch maps in the tonotopic organization?

## Conclusions

The same sequence of *svara*-s manifested differently in different *rāga*-s. *Karṇāṭaka* music is admittedly phrase-oriented. A phrase however is not merely a sequence of *svara*-s as it has a lot more information than can be revealed by the tools of notation. *Svara* and the nomenclature are only a simplified code for communication. The visual depictions do convey a better sense of the subtle nuances.

## Acknowledgements

I would like recall with a great sense of gratitude and relish the insightful guidance provided by Prof. N. Ramanathan and Mr. M. Subramanian of Chennai. I would also like to recognize the encouragement given to me by Dr. S A K Durga to present this paper.

## Reference

**Komaragiri Madhu Mohan (2005).** *Pitch Analysis in Karṇāṭaka Music – An Examination of Intonation and Modern Theories of 22 śruti-s.* Doctoral Dissertation, Department of Indian Music, Madras University, India.

## Software Tools:

PRAAT: developed by Paul Boersma and David Weenink of the department of Phonetics, University of Amsterdam, the Netherlands. Details are available at:

<http://www.fon.hum.uva.nl/praat/>

*Rasika-Gayaka*: developed by M. Subramanian, Chennai, India. Details are available at:

<http://carnatic2000.tripod.com/index.html>