



Spectral Analysis of Dasha Shanti Mantras

R. K.Roshni Raj Lakshmi

Assistant Professor (Guest), Department of Yoga,
Manipur University, Manipur

(L)Prof N. V. C. Swamy

Ex-Dean, School of Yoga and Consciousness,
Swami Vivekananda Yoga AnusandhanaSamsthana University, Bengaluru
Email:pepe.sana1@gmail.com

Abstract:

Study of sound patterns have been done since a long time back. The objective of the present study is to investigate the patterns of sound waves of the *dashashanti mantras*. Three *shanti mantras* namely; *bhadramkarnebih*, *shan no mitrah* and *yascchandasam* were selected and the recordings were done using a software called Sound Forge 8.0 with the help of a sensitive microphone attached to the computer. Three male and three female subjects fluent in vedic chanting were selected for the study. Subsequently, it was found that female voice had more number of formants than male voice. Also, *anudattas* (low pitch) presented more number of formants than *udattas* (high pitch). The study presents an archive of the selected mantras in the form of energy spectra and formants. It concludes that the specified mantras have the specific characteristics in relation to number of formants and peak amplitudes in relation to gender-specific vocal characteristics.

Keywords: *Dasha Shanti Mantras, Energy Spectrum, Formants, Sound Forge, Sound Patterns, Spectral Analysis.*

Introduction

Mantras are the hymns chanted in a specific tone and pitch to gain certain benefits. Systematic research has been done on the sound pattern of English alphabets and the notes of western classical music since the time of Lord Rayleigh (Rayleigh, 1993). A similar study of the Indian musical notes (Carnatic) was done by Chandrashekar et al. (Chandrashekar et al., 2005). Also study has been done on the spectral characteristics of the *gamaka svaras* by Karuna Nagarajan et al. (Nagarajan et al., 2006).

Another research that has been done in this field is on the identification of the spectral characteristics of *Om-kara* and its components A-kara, U-kara and M-kara done by Devi et al (Devi et al., 2004).

The present report also forms a part of this continuum. In this part of the report, an attempt has been made to analyze the spectral characteristics of the *udattas* and *anudattas* in three shanti mantras. *Udattas* and *anudattas* are respectively high and low pitch.

Mantras investigated

The following three Mantras were chosen for the study:

1. *Bhadram karnebhih*
2. *Shan no mitrah*
3. *Yacchandasam*

All the three mantras are chanted with intonations. i.e., they have both *udatta* and *anudatta*. The first mantra is from the *Prashnopanishat*, it also occurs in several other *upanishads* like *Surya*, *Mundaka*, *Mandukya* and *Kaivalya*; the second and third are from *Taittiriyanopanishat bhriguvalli*.

Bhadram karnebhih shrunuyama devah|
bhadram pashye makshabhiryajatrah|
sthiraairangaistustuvagamsastanubhih|
vyasema devahitam yadayuh|
om shanti shanti shantih|

Meaning: O Gods! May we listen to what is meaningful with our ears. May we see with our eyes things that are free from blemish. Glorifying you with Vedic mantras, with strong limbs, may we enjoy our full lives. May Indra of great fame bless us with auspiciousness. May the omniscient sun deity bless us with auspiciousness. May Garuda of unobstructed flight bless us with auspiciousness. May Brhaspati of great intelligence bless us with auspiciousness. Om Peace Peace Peace.

om shan no mitrah sham varunah |
shan no bhavatvaryama |
shan na indro brihaspatih|
shan no vishnururukramah|
namo brahmane|
namaste vayo|
tvameva pratyaksham brahmasi|
tvameva pratyaksham brahma vadishyami|
ritam vadishyami|
satyam vadishyami|
tanmamavatu|
tadvaktaramavatu|
avatu mam|
avatu vaktaram||
om shanti shanti shantih||

Spectral Analysis of Dasha... R. K. R. Raj Lakshmi, (L)Prof N. V. C. Swamy

Meaning: May the sun deity give us auspiciousness. May the ocean deity give us auspiciousness. May the lord of Manes give us auspiciousness. May the ruler of the devatas and the preceptor of the devatas give us auspiciousness. May the all pervasive sustainer of creation Lord Vamana give us auspiciousness. Salutations to the creator. Salutations to you o deity of wind! You indeed are the perceptible truth. I understand you to be the perceptible truth. I declare you to be the right understanding. I understand you to be the truthfulness in speech. May the truth protect me. May the truth protect the teacher. May the truth protect me. May the truth protect the teacher. Om Peace Peace Peace.

Om yaschandasam rishabho vishvarupah|
chandobhyodhyamrtathsambabhuva|
sa mendo medhaya sprnotu|
amritasya devadharano bhuyasam|
shariram me vicarshanam|
jihva me madhumattama|
karnabhyam bhuri vishruvam|
brahmanah kosho'si medhaya pihitah|
shrutam me gopaya||
om shanti shanti shantih||

Meaning: The Omkara which manifested from the eternal Vedas is the greatest among the vedic mantras and is endowed with all forms. Let that lord (Om) strengthen me with intelligence. O Lord, let me become the upholder of that knowledge which is eternal. May my physical body become fit for the pursuit of knowledge. Let my tongue be one that speaks pleasing words. May my ears listen to the scriptures more and more. You are the abode of Brahman, veiled by the knowledge of objects. May you protect my knowledge. Om Peace Peace Peace.

Literature review

Since the time of Lord Rayleigh, there have been researches done on the effect of music on the human system (Rayleigh, 1907). This type of investigation has been further extended to *mantras* also.

In 1993, Telles et al. conducted experiments on the effect of *Om* Meditation on Middle Latency Auditory Evoked Potentials of 18 male subjects between the ages of 25 and 45 years, 9 of whom had more than 10 years of experience in *Om* Meditation and the others had no experience at all. The results indicated that the experimental group showed an increase in the peak amplitude of Na waves, whereas there was a significant decrease in the control group (Telles, 1993).

Very little has been done on the structure of the sound pattern of mantras themselves. A few efforts in this direction can be cited. Jina et al. in 2004

investigated the spectral characteristics of *Omkara* and four other Vedic *mantras*. It was observed that male voice have a larger number of sub harmonics. Also, higher sub harmonics were found to be multiples of the fundamental frequency in *svarita* but it is not so in case of *udatta* and *anudatta* (Devi et al., 2004).

In 2006, Nagarajan et al. investigated the spectral characteristics of *Gamaka svaras*. It was observed that the notes with *gamaka* appear to form an ascending order with the alternate notes rising. Female voice shows a more dominant *gamaka* while male voices due to the rich timbre do not need to emphasize (Nagarajan et al., 2006).

Another research in this field is that of Chandrashekar where he had studied the spectral characteristics of *sapta svaras* or Indian musical notes (Carnatic). He found that the resonance in the male voice is not seen in the female voice (Chandrashekar et al., 2005).

Our study is a continuation of these earlier studies.

Methodology

Experimental Procedure

The following steps were adopted for the experimental program:

1. Recording the signals on a computer with the help of a microphone using Sound Forge Software version 8.0.
2. Checking the signal for noise level.
3. Extracting the Energy-Frequency spectra for the *udatta* and *anudatta*.
4. Extracting the Frequency-time spectra for the *udatta* and *anudatta*.

The recordings were done in a quiet room with less noise in the background. A total of 6 subjects were taken 3 male and 3 female 2 male subjects were from the *Veda Vijnana Gurukula* while the other subjects were trained in Vedic chanting at *Prashanti* as part of their compulsory credits by experts from *Veda Vijnana Gurukula*. *Veda Vijnana Gurukula* is an institute that specialises as an institute that provides gurukula style of education to boys located at Chennena halli, Karnataka. *Prashanti* is the campus of Swami Vivekananda Yoga Anusandhana Samsthana, a premier Yoga and allied sciences institute in South India. All the subjects were given a separate training for a period of 15 days before the final recordings were done. The mantras were chanted in a slow speed to facilitate good recordings. The inclusion criteria were the pitch, right pronunciation of the *alpaprana*, *mahapranas* and right intonation as regards to the *udatta*, *anudatta* and *svaritas*.

The analysis was to identify the waveform

- during *udatta*
- during *anudatta*

The *udatta* and *anudatta* were identified on the waveform by playing the signal using Sound Forge 8.0. A headphone was fixed to the computer and a window of 100 milliseconds was selected during *udatta* and *anudatta*. This window was further viewed in energy- spectrum and spectrogram.

The analysis was done to identify any patterns while chanting the *udattas* and *anudattas*.

Results

The results for the three mantras have been presented under the following categories:

- The waveforms of all Mantras
- The energy-spectra for the entire Mantra
- The Spectrogram for the entire Mantra
- The Energy-Spectra and Spectrogram of the short time window during *udatta*
- The Energy-Spectra and Spectrogram of the short time window during *anudatta*

The total number of *udatta* and *anudatta* notes for the three mantras is as follows:

- *Bhadram karnebhih* has 11 *udatta* notes and 10 *anudatta* notes
- *Shan no mitrah* has 16 *udatta* notes and 19 *anudatta* notes
- *Yaschandasadam* has 17 *udatta* notes and 16 *anudatta* notes
- The list of figures obtained from an analysis of the recordings is as follows:

A) *Bhadram karnebhih*

1. Waveform 6 (3 male and 3 female)
2. Energy-Spectra of the entire mantra-6 (3 male and 3 female)
3. Sonogram of the entire mantra-6 (3 male and 3 female)
4. Energy-Spectra of the 10 lower notes-60
5. Sonogram of the 10 lower notes-60
6. Energy- Spectra of the 11 higher notes-66
7. Sonograms of the 11 higher notes-66

B) *Shan no mitrah*

1. Waveform 6 (3 male and 3 female)
2. Energy-Spectra of the entire mantra-6 (3 male and 3 female)
3. Sonogram of the entire mantra-6 (3 male and 3 female)
4. Energy-Spectra of the 19 lower notes-114
5. Sonogram of the 19 lower notes- 114
6. Energy- Spectra of the 16 higher notes- 96
7. Sonograms of the 16 higher notes- 96

C) Yashchandasam

1. Waveform 6 (3 male and 3 female)
2. Energy-Spectra of the entire mantra-6
3. Sonogram of the entire mantra-6
4. Energy-Spectra of the 16 lower notes- 96
5. Sonogram of the 16 lower notes- 96
6. Energy- Spectra of the 17 higher notes-102
7. Sonograms of the 17 higher notes-102

The following were the settings used in the extraction of Energy-Spectra and Sonograms from the waveform.

FEMALE

Name:	untitled
FFT size:	2048
FFT overlap (0-99%):	75
Smoothing window:	
Blackman-Harris	
Slices displayed (1 to 64):	1
Set Sonogram resolution (1 to 10000 samplings):	100
Logarithmic graphing (normal display only):	
Display range	
Frequency minimum (0-47.9KHz):	20
Frequency maximum (0.001 to 48 KHz):	7500
Ceiling (-149 to 0dB):	0
Floor (-150 to -1dB):	-90
Monitor settings:	
Hold peaks during monitoring (1 to 60 secs):	3.0
Maintain last monitored view	

MALE

Name:	untitled
FFT size:	2048
FFT overlap (0-99%):	75
Smoothing window:	
Blackman-Harris	
Slices displayed (1 to 64):	1
Set Sonogram resolution (1 to 10000 samplings):	100
Logarithmic graphing (normal display only):	
Display range	
Frequency minimum (0-47.9KHz):	20
Frequency maximum (0.001 to 48 KHz):	5000

Ceiling (-149 to 0dB):	0
Floor (-150 to -1dB):	-90
Monitor settings:	
Hold peaks during monitoring (1 to 60 secs):	3.0
Maintain last monitored view	

Based on the values of the frequencies and decibel levels of the several sub harmonics during the notes, both qualitative and quantitative analysis has been done to draw certain conclusions.

Discussion

The results available for the study are the various Waveforms, Energy-Spectra and Sonograms of three Mantras including *udatta* and *anudatta* notes for the three *mantras*. All the three mantras contain inflections with the *udatta* and *anudatta* notes with the *svarita* notes in between. All the results have been discussed under the section u and a. It was noticed that all u notes had similar spectra and sonograms and all a notes also exhibit similar spectra and sonograms.

A setting is adjusted in the sound forge software for specific needs. For our study, a ceiling and floor were adjusted at decibels of (-149 to 0dB) and (-150 to -1dB) so that the intonations can be caught properly while recording.

Another interesting feature that is observed is that the inflections of the formants upwards and downwards is more prominently seen in the 300 milliseconds window rather than on the 100 milliseconds window which is usually adopted. This can be clearly seen in the spectrograms.

A sample of *udatta* and *anudatta* is selected from the *mantras*. *No* as in *shan no* in *shan no mitrah* is taken as the sample for *udatta*. From the waveform, it is seen that there is a sudden rise and gradually tapers off. In the spectrogram, it is observed that the formants dip slightly before the *udatta* and rises to come back gradually. This rise is not seen in the bottommost formants as they are characteristic of the voice rather than the intonation or notes.

De as in *devahitam* is taken as the sample for *anudatta*. Here, the waveform shows a minimal rise for *de* from the *svarita* and gradually tapers off. In the spectrogram, the formants dip slightly the deepest undulation being at the top with increasing frequency.

These features are evident in other *udattas* and *anudattas*.

Udatta

At the place of *udatta*, there is a displacement of all harmonics towards higher frequencies. The displacement is seen to be lowest near the fundamental frequency, increasing progressively at higher frequencies.

Anudatta

On the contrary, at the location of the *anudatta* note, the formants bend downwards and form a valley. The change in the fundamental frequency is negligible. This is because the fundamental frequency is characteristic of the voice rather than of the note. However, as one progresses to higher frequencies the displacement in the frequency increases gradually reaching its highest value at the higher harmonics, after which the signal itself fades away. This is borne out well by the tables and sonograms. It is also noticed that there are more number of formants in case of *anudattas* as compared to *udattas*.

Conclusion:

The current study has tried to build an archive of the selected mantras in the form of energy spectra and sonograms for future reference. Specific characteristics of the mantras and their intonations like *udattas*, *anudattas* and *swarita* are studied. Gender- specific characteristics like increased number of formants and higher amplitudes in the energy spectra are observed in female voice. Future studies can be taken up with larger sample size and more robust study design to arrive at results. Also, studies can be taken up to assess the effect of the mantras on human physiology and clinical conditions. The small sample size and study of only the sound characteristics can prove to be limitations of the study.

References:

1. Chandrashekar, J., Devi, H.J., & Swamy, N. V.C., & Nagendra, H.R. (2005). Spectral Analysis of Indian Musical Notes. *Indian Journal of Traditional Knowledge*, 4 (2), 127-131.
2. Devi, H. J., & Swamy, N. V.C., & Nagendra, H.R. (2004). Spectral analysis of the Vedic mantra Omkara. *Indian Journal of Traditional Knowledge*, 3 (2), 154-161.
3. Nagarajan, K., Devi, H.J., & Swamy, N. V.C., & Nagendra, H.R. (2006). Spectral analysis of Gamaka Svaras. *Indian Journal of traditional knowledge*, 5 (4), 439-444.
4. Rayleigh, L. (1907). On our perception of sound direction. *The London, Edinburg and Dublin Philosophical Magazine and Journal of Science*, 13 (74), 214-232.
5. Telles, S., & Desiraju, T. (1993). Recording of auditory middle latency evoked potentials during the practice of meditation with the syllable "OM". *The Indian Journal of Medical Research*, 98, 237–239. <https://europepmc.org/article/med/8119759>