Chapter 7 - Violin playing: computer analysis

Brief summary:

- Computer analysis of gamakas as given in SSP
- Harikambhoji raga alapana played by Sri Papa K.S. Venkatramiah
- Sample Raga alapana by Mysore T. Chowdiah
- Sample Raga alapana by Dwaram Venkataswamy Naidu
- Comparative Analyses of the violin playing styles.

Attractive and distinctive tone, its continuity, easy tenability to various pitches, good and usable range of 3 octaves, easy production of the various swarasthanas, the various gamakas and the modulation in volume – all the features have made the violin a preferred choice as an accompanying instrument in Carnatic music concerts.

It must however be noted that some styles of violin playing which incorporate the anuswaras in a better fashion have been found to be more suited to both solo and accompaniment as well as collaborative performances of Carnatic music.

The analysis was done for its tone, plain swaras and gamaka swaras as swaras played individually and in a single bow – with uniform and intermittent bowing pressure (corresponding to akaram and tanam). First we look at the plain notes sa, pa and Sa as played on the violin.

An illustration using violin

A good illustration has been taken up – the production of tone in different violins using different bowing methods.

The violin volunteers used different types of bowing and the recordings were then analysed to show the tonal quality, as shown in the previous chapter.

The notes can be seen as a flat blue line, indicating a steady frequency over the period of the note, but the notes are of varying sound intensity, due to the bowing and the characteristic
Figure 7.1 Comparative analysis of different violins and different volunteers.

In the above picture, 3 violins can be seen to play the plain un-adorned notes s, r, g, m and p in the scale of Mayamalavagowla.

- Spectrum analyses is not taken up as it is difficult to visually sum up the information shown in the spectral analysis. Formants, actual frequencies and sound intensities are easier to visually interpret.
• The red horizontal lines represent the formants: note that the second violin has 5 formants for almost all the notes. Indicating the better tone.
• At a glance, we can infer that the length of the individual notes is slightly longer for the 1st violin, and so also the gap or spacing between notes.
• The green intensity line shows the natural response curves of the 3 violins. All 3 show an increase in intensity for the note ri and a gradual tapering of the intensity in ma and pa.

Figure 7.2 Comparatives of 3 different bowing positions.
In the above picture, the same violin and the same volunteer have been evaluated. The top part of the picture shows the differences in the volume levels of the 3 stages clearly. This experiment, based on various technical aspects such as bowing pressure, volume, sound intensity, sound spectrum and formants, has clearly and graphically shown up the differences, thus highlighting the importance of using proper bowing technique to produce rich and sustained and powerful tone.

This method can also be used to compare 2 voices or 2 instruments to indicate their tonal qualities. It also leads to the possibilities of voice or instrument recognition / verification / comparison etc. It must be also kept in mind that once the audio file is formed by a mixture of instruments, the analysis becomes more complicated.

Figure 7.3 Calibrating a violin for Praat analysis
The response of the violin used is noted. It has been tuned to the note ‘C’... and we recall that in the vocal case, the basic frequency of the note was around 130.5 Hz. Here the violin shows a basic frequency of 261 Hz, indicating that the sound of the violin is an octave higher than the voice. We can also see that there is an abrupt drop in the volume, but the violin is still resonating, as can be seen in the fading of the sound spectrum. So the visible range of the frequencies has been kept between 200 and 600Hz. We can also note that the average volume of the notes ‘pa’ and ‘Sa’ are different from that of ‘sa’ as a characteristic of this instrument.
Next, we analyse the violin playing plain notes ‘s’, ‘r’, ‘g’, ‘m’, ‘p’, ‘d’, ‘n’ and ‘S’ in the scale of Mayamalavagowla. The notes are played as flat notes, without gamakams and there is no ‘joining’ of one note to another.

![Figure 7.4 Violin playing Mayamalavagowla with unadorned notes](image)

Here it is seen that the resonance between notes is reduced, except when the note is played as an open string (sa and pa). Also, sound intensity within a single note varies, as can be inferred from the yellow line (indicating the dB) and the black waveform envelope.

![Fig 7.5 Violin playing Mayamalavagowla ragam arohanam as gamakams](image)
Fig 7.6 Violin playing plain notes ‘S’, ‘n’, ‘d’, ‘p’, ‘m’, ‘g’, ‘r’ and ‘s’ in the scale of Mayamalavagowla.

Fig 7.7 Violin playing Mayamalavagowla ragam avarohanam as gamakams

The above figures further corroborate the expected shapes of the blue frequency line to indicate the manner of playing the avarohana in Mayamalavagowla.
To get the idea of the frequency of the other notes, the scale of the Hemavathi raga is played and analysed.

Now, the full gamakas can be analysed easily in this phrase “gmp..m gr, s….

- g - Note the start of the swara g from r, the quick etra Jaru to p, and erakka Jaru to g.

- m is played as pmp (can be seen as the small dip in the blue line).

- pm is played as a flat note p followed by a pmp for m.
g r is seen as the sliding descent from the upper notes

s is seen as the abrupt drop from r to s

Complex phrasing – occurring in raga alapana:

![Graphical Analysis of Gamakams](image)

Fig 7.8 Analysis of gamakams for the complex phrase “gmpdn. dpmg. r .... s....”

We can thus follow the phrasing graphically above, for the complex phrase “gmpdn. dpmg. r .... s....”

Thus, it can be concluded from the graphs for the violin phrases and also for the veena phrases looked at earlier, that all raga phrases, irrespective of size or complexity can be split up and analysed.

It can also be concluded that the Praat analysis and the FTA graph both clearly proved the superiority of certain bowing methods as compared to others, for extracting the best tone from the violin.

The artistes Shri Papa K.S. Venkatramiah, Shri Mysore T. Chowdiah and Shri Dwaram Venkataswamy Naidu were analysed using their solo concert recordings.

The recordings were also analysed mainly from the point of tonality and also raga development aspects.
The different types of gamakam usages by both artistes are clearly seen and analysis of Notation and comparisons with established patterns of prastharas like Sarali, Janta, Dhatu and Alankaram.

Sample alapana played by Sri Papa K.S. Venkatramiah.

In the words of Sangita Kalanidhi Shri T.N. Krishnan,

“Papa Iyer’s musical bani was an extraordinary one, technically superior and emotionally rich. He had a smooth and continuous bowing style, and a masterful fingering technique that would make the violin sound vocal, especially when played in the lower octave.

His uncompromising approach extended beyond his music. Even his choice of strings for his violin reflected his mindset _ he would exclusively use high quality gut strings that produced the best tone, even when they were hard to come by. He used to say in a lighter vein, ‘even after all these years, I am still learning to play Bhairavi varnam.’ That was the extent of humility and reverence he had for the work of the master composers of our Carnatic tradition.”

Harikambhoji raga alapana played by Sri Papa K.S. Venkatramiah.

Fig 7.9 Wavelab analysis of harikambhoji alapana by Papa Venkatramiah

• Note the use of the yellow markers on the time line. The entire alapana is of 5min and 25 secs duration approximately.
• The alapana has been split into 5 stages (A, B, C, D and E), excluding the initial 21 seconds of tuning. The third stage C has been highlighted in the program. We can note the tuning done in the pegs, and the characteristic sound of the gut strings.
• The violin accompaniment has been provided by his son Shri V. Thyagarajan, and mostly the accompaniment replies are in the lower octave, though clashes occur. So, careful judgement has been used to find out the actual sangathis used by Shri Papa alone.

Now we split Stage A into the individual sangathis – they can be drawn out into a separate Wavelab as per the markers seeb below:

![Fig 7.10 Wavelab analysis of the Stage A in Harikambhoji alapana by Papa Venkatramiah](image)

The sangathis are then tabulated as shown below:

<table>
<thead>
<tr>
<th>S.no</th>
<th>Sangathi</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>p, p…</td>
<td>The recording has an incomplete start – faulty recording technique.</td>
</tr>
<tr>
<td>2</td>
<td>g m p..SnSnd..Sndp</td>
<td>Praat used to decode the fast phrase.</td>
</tr>
</tbody>
</table>
Next, one sangathi alone can be focussed upon and analysed in the Praat program.

| 3 | p. dndp m g ... |
| 4 | g, g, g, g, g, gmgr, gm p dndp pp.mgpmgr |
| 5 | gr gr gr gmgr gm m.dp p.pmg,p mgmg r, s... |
|   | Notice the delicacy of mgmg in the image. |
| 6 | s, s, sr gm, mr gs grgrgrp mgmg...p mgmgr, s |
| 7 | s rg.mg r.mgr.r s...s.s. n.s r.grs.r ss nn.d |
| 8 | d.d.d dpd nrs ssndp...pdndpd.pmgr pmn, sr,g.m. |
|   | p. dndp mg, p mgmg r, grgrgrp mgmg...p mgmgr, s... dndnp.... |
|   | A masterly touch. |
|   | A long and yet intricate sangathi |

Fig 7.11 Praat analysis of the 5th sentence of Stage A in Harikambhoji alapana by Papa Venkatramiah

Note that the graphs can be easily inferred for swarams and gamakams, with their relative speeds and placing of notes. The picture also is clearer since the band spectrum and yellow intensity lines have been discarded. The same process of notation is followed for the other stages B to E.
The above data can be used along with the knowledge of the gamakams and the raga lakshanas to interpret the entire alapana as a cohesive notation, in both text as well as graphical form. Another sangathi is shown in the Tara sthayi below:

![Praat analysis of Tara sthayi sangathi in Harikambhoji alapana by Papa Venkatramiah](image)

Fig 7.12 Praat analysis of Tara sthayi sangathi in Harikambhoji alapana by Papa Venkatramiah

Now, the formants can be analysed to get an idea of the tonal quality of the music.

![Praat analysis of Violin tone in Harikambhoji alapana by Papa Venkatramiah](image)

Fig 7.13 Praat analysis of Violin tone in Harikambhoji alapana by Papa Venkatramiah
Summary of Observations and conclusions for this analysis.

1. Purity of tone: 2 clear formants and 2 upper region formants can be seen both in open string bowings and during the notes. Even when there are abrupt changes in the swaras due to fingering, the volume intensity remains fairly constant over the length of the phrase.

2. Purity of note: we can see in the graphical representations that both flat notes and gamakas are played with a very fair degree of accuracy.

3. Purity of phrasing: phrases like mmmgmg m.dp occur with such perfection …. The frequency curves appear so perfect, even though the notes are so closely placed.

4. All sangathis start correctly with p, g, r or s ….and end on appropriate graha swaras, thereby ensuring that the raga lakshanas are followed.

5. Characteristic style can be found in the starting note repetitions (g, g, g, g, or s, s, s, s, etc.) that occur at the beginning of almost every other sangathi: refer to sangathis 4, 5, 6 and 8.

6. Another characteristic style feature if the occurrence of huge compound raga sentences made up of intricate ‘pidis’ or phrasings, all joined seamlessly together as a raga garland…

Thus we can analyse and sum up the elements of style from the alapana of Sri Papa Venkatramiah and see how much these elements have to offer to any student of Carnatic violin. No wonder that the Papa style had and has many adherents, and it has become a very prominent school of thought in violin playing. Truly a Majestic and Masterly style!

Sample Raga alapana by Mysore T. Chowdiah

The following excerpt from Wikipedia describes him concisely:

“Chowdiah, was born in Tirumakudal Narsipur village on the banks of the river Kaveri near Mysore. He became a disciple of Mysore Royal Court musician, Ganavisharadha Shri. Bidaram Krishnappa in 1910 and underwent a very rigorous and disciplined training until 1918 in the Gurukula system.

In his early years, he played the four stringed violin, and by 1927 he became an extremely well known violin accompanist. Those were the days when there was no sound amplification
equipment and it was rather difficult for listeners who sat in the back rows of music halls to hear him playing the violin.

Chowdiah realized this shortcoming and launched upon increasing the sound of the violin. He improvised the violin by adding three more strings such as Tara Shadja – Mandra Shadja, Madhya Panchama – Mandra Panchama and Madhya Shadja Mandra Shadja. After practicing incessantly, he began to use this new seven stringed violin in all his concerts. He experimented, innovated and practiced to achieve perfection.”

A sample alapana in Kapi ragam is analysed to make a preliminary evaluation.

![Fig 7.14 Praat analysis of a complex sangathi in Keeravani alapana by Mysore Chowdiah](image)

When we write the notation, we come across the following passage, which is also graphically shown in the Praat program above.
Observations

- From the notation analysis, it can be concluded that Shri Chowdiah developed raga in a systematic manner (note by note, or phrase by phrase, as it were) as opposed to the slightly more intuitive style of Shri Papa.

- While the earlier part of the alapana has glides akin to Shri Papa Venkatramiah’s style, lots of fast phrasings are used (typically in the 4th speed – 8 notes per standard tempo of 84 bpm) where the swara are hrasva – very

- Sangathis are developed from the previous sangathi – with lots of imagination and intuitive twists.

<table>
<thead>
<tr>
<th>S.no</th>
<th>Sangathi</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>S…. nSRGRRSS…S</td>
<td>From the middle of the alapana, a phrasing series starts.</td>
</tr>
<tr>
<td>2</td>
<td>S…. nsRGRSS….nSR. SRG. RRGRSS….S</td>
<td>Development of the series from the previous one. Praat used to decode the fast phrase.</td>
</tr>
<tr>
<td>3</td>
<td>p.GRRSS…nd…</td>
<td>Again the series starts, with a modified beginning and ending</td>
</tr>
<tr>
<td>4</td>
<td>p.G GRRSS..nSR GRRSS…nd</td>
<td>Development</td>
</tr>
<tr>
<td>5</td>
<td>pGGRRSSnnddpmgrgmpdnSRGRRSS…nd</td>
<td>Notice the further development. The software is unable to capture the full picture when the sangathi goes into the nddpmgrgmpdn phase</td>
</tr>
<tr>
<td>6</td>
<td>pGGRRSSnnddpmsg rgmpdpmg rgmpdnSRSnndpmg rgmpdnSRGGRSSndpmgrsrgmpdnSRGR SRRSnRSN dndSnRSndnddpmgrgmpdn SRGR….RGS……. RGRRS S….n S….n S….n n.S.R.S.R.G.M. SRS..MGG..R…….</td>
<td>Around 14 different sub phrases of around 10 notes each, mostly as pure notes, and at 4th speed. A masterly touch.</td>
</tr>
</tbody>
</table>
• The general speed of the phrasings is faster, as compared with the phrasings of the previous analysis of Harikambhoji by Shri Papa, and could be due to the singularity of the style as well as the diverse nature of the ragas.

• The proportion of pure notes as opposed to glides and anuswarams is much higher, thus validating 2 earlier hypotheses –

Focus on a particular aspect of music leads to the formation of styles

The performing style of an artiste indicates his or her potential.

The reasons are not difficult to understand, if we also take into account the factor that the 7 string violin (It was actually a modified viola, according to certain reports) invented by Shri Chowdiah had the conditionality of two strings in different octaves placed close to each other on the fingerboard. This makes it difficult for the performer, as both strings have to be perfectly in tune at all times and the finger placing should also be extra firm and perfect. Hence the preference for fast and long phrasings – leading to formation of this style. And we can see how skilled and ingenious Shri Chowdiah was, in having thought of such an instrument, and implemented the style too.

Sample Raga alapana by Dwaram Venkataswamy Naidu

Dwaram Venkataswamy Naidu (8 November 1893 to d. 25 November 1964) was the most important Carnatic Violinist of the 20th century. He was born in November (Deepavali day), in Bangalore, India and was raised in Visakhapatnam. He was appointed Professor of violin in the Maharaja’s Music College in Vijayanagaram, at the young age of 26, and became its principal in 1936. He was the first one to start the violin solo concerts. His first solo concert was given in Vellore in 1938. He played at the National Physical Laboratory auditorium, New Delhi in 1952, to raise funds for the Blind Relief Association. Yehudi Menuhin, a world renowned violinist, was greatly impressed when he heard Dwaram play at Justice P.V. Rajamannar’s house. Dr. Dwaram was for his extremely well developed soft bowing technique combined with a firm fingering technique.
Awards presented to Dr. Dwaram Venkata Swamy Naidu

- Madras Music Academy presented him with Sangita Kalanidhi in 1941
- He received Sangeet Natak Academy Award in Fine Arts in 1953
- Padma Shree Award was conferred on him in 1957
- Indian Postal Department has released a commemorative stamp on his birth centenary in 1993

Fig 7.15 Praat analysis of a relaxed sangathi in Keeravani alapana by Dwaram Venkataswamy Naidu

Next, as seen above, this phrasing in Kapi raga comes in the 36\textsuperscript{th} second of a six minute alapana. Note the reposeful nature of the sangathi.

Fig 7.16 Praat analysis of a complex sangathi in Keeravani alapana by Dwaram Venkataswamy Naidu
Above is a Kapi sangathi of very exquisite beauty – the swaras used are in 4\textsuperscript{th} speed, discrete, yet such continuity in bowing and perfection! The swaras are notated in the graphic diagram itself.

The Praat graphics below show the majestic, slow and beautiful sangathis that occurs towards the end of the alapana. The sangathis can be said to have very high aesthetic value.

Figs 7.17 & 7.18 Praat analysis of the concluding sangathis in Keeravani alapana by Dwaram Venkataswamy Naidu
The end sangathi tapers perfectly out on the Ati Tara shadjam, indicating that besides the vocalisation of the Kapi that was being kept in mind, the full potential of the artiste and that of this lovely instrument is shown in the finale sangathi.

**Observations**

- From the notation analysis, we can conclude that Shri Naidu developed raga in a distinctly aesthetic manner and was fully aware of the raga lakshana and raga bhava.
- While the earlier part of the alapana has slow sangathis, the usage of pure notes and the perfection in the gamakas (especially Shuddha swara and anu swara combination like SnS other Jaru gamakams between pure notes like pmp, mrm etc.) and lots of fast phrasings are used (typically in the 4th speed – 8 notes per standard tempo of 84 bpm).
- Mostly Sangathis are developed from the previous sangathi with lots of imagination and intuitive twists. The general speed of the phrasings is relaxed, and could be due to the singularity of the style as well as the diverse nature of the raga.
- The proportion of pure notes as opposed to glides and anuswarams is much higher, but from a perspective of the sangathis formation, which do not follow any set pattern, or go note by note, we can conclude that the raga elaboration by this artiste indicates his great potential.
- Very creative and original ending for the raga… a definite style pattern emerges here. Also, Excellent violin tone : the presence of the 4 clear formants and a floating formant even at the Ati Tara shadjam

Thus we are able to trace an entirely different style of play in the music of Shri Dwaram Venkataswamy Naidu. The emphasis of this style is on tonal purity, and it can be said to be based slightly more on pure notes than on anu swaras and glides. Raga bhava comes coupled with creative expression and superb note clarity, because of excellent tone and perfection in technique and bowing. Note a few instances when the perfectionist in the personality of the artiste comes through – he repeats phrasings immediately, with better ideas and perfection in execution.