The 'Maya' of Pitch and Frequency

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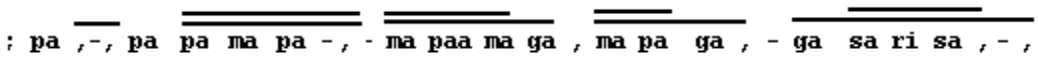
In their paper “Science and Music vis-a-vis Science in Music” (available at http://www.musicresearch.in/) Hema Ramanathan and Dr. Ramanathan have referred to a private email sent by me with a musical clip “M.Subramanian had in a personal e-mail to me (dated 29-09-2004) sent a recording of the pallavi of the krti "Apparramabhakti" in the raga Pantuvarali synthesised using the pitches of Sankarabharanam (!) and pointed to the 'maya' that we would be living in if we were to take the sargam codes to be true representatives of the physical forms.“

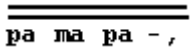
Readers might be wondering what exactly this was. The idea of experimenting on the ranges of gamakams arose from my observation in my paper on gamakams of Mayamalavagowla “**Analysis of Gamakams of Carnatic Music using the Computer”** published in 'Sangeet Natak' **(**a copy of which is available at http://carnatic200.tripod.com/gamcomp.zip in zip format.). That study of many vocal music recordings revealed that in terms of frequencies the upper limit of the gamakam of Suddha Rishabham went far above the Suddha Rishabham position and even upto the Cathusruthi Rishabham position. I had also suggested that the sense of the pitch conveyed is roughly based on the weighted mean of the pitches during the gamakam. That study also showed that in oscillated ri and da the mean tended to be lower than the theoretical values.

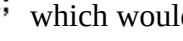
I then wrote a few phrases of 'ApparamaBhakthi' in my Gaayaka software. This song is set in Panthuvarali ragam (Melam 51) in which ri, ma and da are 'black' notes and different from the notes of Sankarabharanam (Melam 29). In Gaayaka we type the notes, set the Melam and play the music. In my experiment I set the Melam to 29 and I chose phrases where these 3 notes are not held straight but held with gamakam. When I wrote the detailed notation for playing the gamakam for the 3 notes I made the notes consist of only transitions from and to the anchor note without staying at the note itself (ri, ma or da). This ensured that the weighted mean of the pitches of ri and da during the oscillations would be far less then that of the upper limits of the notes actually used i.e. Chathusruthi Rishabham or Chathusruthi Dhaivatham. In the case of ma.the mean frequency becomes much higher than Suddha Madhyamam which is the lower limit.. Actually the mean frequencies were even less than the pitches of the suddha notes for ri and da and higher than the pitch of prathi madhyamam. The result did convey the raga bhavam correctly. To enable even those who do not have Gaayaka software I saved the music in .mp3 format and I am attaching the file 'AppaRAma29.mp3'. The Gaayaka notation is also attached as AppaRma29.gka which contains an additional symbol fullstop for indicating half a note duration (half of a comma)

The first line of the actual notation used in the experiment is given below. Gaayaka uses brackets '(' and ')' to show higher kalams. I have converted the notation of Gaayaka for convenience of readers accustomed to the conventional way of writing (lines for higher kalams), which is given below. The melam was set to 29 (Dheerasankarabharanam) and note duration to 200 ms.



The usual non gamakam notation for this may go as **paa ; pa ma ga ma gaa ree**

The first ma in the notation has been written as  for imparting gamakam to ma, anchoring on pa coming down and going back. The total note count is 1 (one fourth each pa ma pa and comma) As the melam selected in Gaayaka for playing this notaiton was 29 the ma is having relative frequency (r.f.) of 4/3 (498 cents) instead of 64/45 (610 c) or 45/32 (590 c) required for Pantuvarali Prathi Madhyamam. The total duration of the note (including the end comma which is silence in Gaayaka, comming after the hyphen) is 200 milliseconds (ms) and that of each note is 50 ms. In Gaayaka the standard transit duration between connected notes is 50 ms which is taken off the duration of the second note Because of this, in this case the ma is held for 0 ms (50 -50) only i.e the pitch goes down to Suddha Madhyamam and immediately returns to pa. The actual durations are pa - 50 ms, transit to ma 50 ms, ma proper 0 ms, transit to pa 50 ms pa proper 0 ms and the silence 50 ms. The note is held for a total of 150 ms followed by a silence of 50 ms. However the weighted mean r.f for the entire note (excluding silence) as entered works out to 261.7/150 = 1.44 (653 cents) which is even closer to pa than the 2 values of prathi madhyamam mentioned above. So, in spite of using the Suddha Madhyamam the pitch felt by the listener is Prathi Madhyamam. The other black notes Suddha Rishabham and Suddha Dhaivatham are also generated similarly by transit from sa and pa to Chathusruthi Rishabham and Chathusruthi Dhaivatham respectively, but cutting down the durations of the Chathusruthi notes to 0 and maintaining the mean r.f closer to sa or pa creating the pitch sensation of Suddha notes.

However the notation would require change if the tempo is changed increasing the note duration. If we fix the note duration to (say) 320 ms then ma would have a duration of 80 ms from which only 50 ms would be taken by the transit and ma will actually sound for 30 ms and may give a sense of momentary Suddha Madhyamam. In such a case either the duration of ma can be reduced by taking to higher kalam or by adding \ symbol which increases the transit to 100 ms (limited to the duration of the next note). On the other hand if the melam had been set as 51 then the mean r.f would even be closer to pa and it may not be necessary to take ma to the 2nd kalam and the notation could have been written as  which would work all right in wider changes of durations.

What is the point behind this exercise ? As pointed out by Hema and Dr.Ramanathan, we would be living in a 'maya' if we believe that frequencies of notes decide everything in a musical system like Carnatic Music which is heavily phrase oriented and in which movements between and around notes take a lion's share compared to steady notes. We hear talk of Saveri rishabham being 256/243 in r.f and Mayamalavagowla being 16/15 and so on. How can we talk of a single frequency for a note which is constantly in a fluid state? No musician would stop at rishabham in Saveri without gamakam for any perceptible duration Even a Vainika, when forced to play ri on the sa string during descent would touch the fret and take his left hand fingers off the fret so that he actually plays 'ri sa' bringing down the mean r.f of ri which makes us feel that the Rishabham of Saveri has a lower pitch. It is time to think whether we should continue to discuss

Carnatic Music as practiced to day on the basis of 22 srutis generated by sa - pa cycle of fifths and sa - ma cycle of fourths, which is basically a Western approach requiring consonance between notes in polyphony.

There is no need to bolster our pride by saying that we have a sensitive ear to appreciate microtonal variations and that we have 22 srutis in place of the Western 12 notes. In fact the classification of scales based on Venkatamakhi's Chaturdandiprakasika became successful only because it uses only 12 of the 22 srutis. There are infinite variations in the shades of notes which cannot be ensconced within the confines of 22 srutis. Kohala is quoted as saying that the Sruthis are infinite ('Aananthyam') The subtleties of gamakams go beyond mere frequencies of notes.