Swara Sthapana on *Shruti Veena* or *Shruti Sitar*

(Establishing Musical notes on *Shruti Veena* or *Shruti Sitar*)

Dr. Vinod Vidwans

Professor and Chair
FLAME School of Fine and Performing Arts
FLAME University,
Pune, India

Establishing *swaras* and *shrutis* in a *saptaka* as per the description from Bharata's *Natyashastra* has been an outstanding issues and it is widely debated among Indian musicologists and scholars. Based on the description of the *Natyashastra* of Bharata some of the scholars have argued that *swaras* are established first because description of *swaras* comes before the description of *shrutis*. But if we closely read the text then it is evident that it is not the case. It is true that the description about *swaras* comes before *shrutis* but one should also note that the process of establishing *swaras* in a *saptaka* is explained in terms of *shrutis*. This clearly shows that Bharata presupposes the knowledge of *shrutis* as well as the knowledge of `*shrutyantara'* or the distance between *swaras* in terms of number of *shrutis*. It is worth mentioning here that *Naradiya Shiksha* uses `*swarantara'* (distance between two *swaras* in terms of *swara-bhava*) as the unit of measurement while *Natyashastra* uses `*shrutyantara'* (distance between two *swaras* in terms of number of *shrutis*) as a unit of measurement. In the *Sangita Ratnakar* of Sharangadeva, it is very clear that *shrutis* precede *swaras*. He establishes twenty two strings on the *Veena* and then establishes *swaras* on them. It is also true that the ancient musical practices were still alive till the time of Sharangadeva. There existed a continuity of musical tradition from Bharata to Sharangadeva. The process of *swara-sthapana* described in *Natyashastra* clearly indicates that the knowledge of *shruti* is necessary for the establishment of *swaras* in a *saptaka*. Only major difference between Sharangadeva's description and Bharata's description is that Sharangadeva has aurally established equi-distanced twenty two different strings (each dedicated to each *shruti*) for establishing *swaras* in a *saptaka*. Bharata does not mention where to establish *swaras*. Probably he assumes that *Veena* already has aurally equi-distanced frets and on any of the frets the first *swara*, the *Vadi*, has to be established. Of course, this assumption is also not required. Even today many musical instruments do not have frets viz. violin, *Sarod* and *Rudra Veena*. Still musicians know exact places and locations of *swaras* on the strings by aural judgement. Therefore, it is quite

possible that Bharata's *Veena* may not have twenty two frets for twenty two *shrutis*. Therefore, `swara-sthapana' in Bharata's description could be with frets or without frets.

If we read Bharata's description of *swara-sthapana* carefully then it is clear that he describes relationship between *Vadi* and *Samvadi* in terms of number of *shrutis*. He says distance between *Vadi* and *Samvadi* is either thirteen *shrutis* or nine *shrutis*. Similarly *Vivadi* swara is also described in terms of two-*shruti* distance. It means knowledge of *shrutis* as well as the knowledge of *shruti-distances* is necessary to establish *swaras* in a *saptaka*. It is possible that the *shruti* distances can be differentiated by ear alone. There is no need of frets on the Bharata's *Veena*. For a musically trend ear it is very easy to recognize the *Shadaj-Pancham Bhava* which is supposed to be the thirteen-*shruti distance*. Similarly, the nine-*shruti* distance i.e., *Shadja-Madhyama Bhava* is very prominent, though not very easy to recognize. In the same manner two-*shruti* distances is also distinct and unique that Bharata terms as *Vivadi* (dissonance) distance. In contemporary piano or a harmonium the semitone distance is the distance between *Ga* (E) and *Ma* (F) notes which is very easily distinguishable due to its dissonant qualities. It is approximately close to two-*shruti* distance. So it is quite likely that musically trained ears can easily recognize and remember these distances. This possibility is more realistic and practical.

It is important to note that Bharata himself has nowhere given the description of *swara-sthapana* explicitly. But if we follow the textual description closely, we realize that the description of *swara-sthapana* is implicitly present in the text. He mentions that

वादिसंवादिविवादिषु स्थापितेषु शेषास्त्वनुवादिनः| [Bharata, p. 15].

After `establishing' the *Vadi, Samvadi* and *Vivadi swaras* as explained all the remaining *swaras* are called *Anuvadi swara* [Bharata, p. 15]. The word `sthapiteshu' clearly assumes that all the description in the relevant *shlokas* is aimed at establishing *Vadi, Samvadi* etc. *swaras* as described. The *shloka* numbers twenty one, twenty two and twenty three, from the twenty-eighth chapter of Bharata's *Natyashastra,* give the description of seven *swaras* and their names and then says that there are four musically significant qualities called *Vaditva*, *Samvaditva*, *Vivaditva* and *Anuvaditva*. This is clearly mentioned in the next two *shlokas*.

षड्जश्च ऋषभश्चैव गान्धरो मध्यमस्तथा | पञ्चमो धैवतश्चैव सप्तमोऽथ निषादवान् || [*Natyashastra:*28-21]

There are seven swaras as: *Shadja, Rishabha, Gandhara, Madhyama, Panchama*, *Dhaivata*, and *Nishada* [Bharata, p. 10]. As per the tradition of *sutra* codification Bharata gives a name-list of *swaras* in order. Then he goes further to describe their potential and musical application.

चतुर्विधत्वमेतेषां विज्ञेयं गानयोक्तृभिः | वादी चैवाथ संवादि विवादी चानुवाद्यपि || [*Natyashastra:*28-22]

These *swaras* are used by musicians in four different ways as: *Vadi* (tonic or fundamental note), *Samvadi* (consonant), *Vivadi* (dissonant), and *Anuvadi* (Assonant) [Bharata, p. 14]. In connection with the previous *shloka* it means that each of the above-mentioned seven *swaras* can have important functions/ roles in musical rendering. These functions are useful in composing music. In this sense *Vaditva, Samvaditva, Vivaditva* and *Anuvaditva* are four important functions of *swaras* in Indian music. Next statement gives a cryptic definition of a *Vadi swara*.

तत्र यो यदंशः स तदावादी‌| [Bharata, p. 15].

Swara that defines the octave and musical significance of other *swaras* is called a *Vadi swara* [Bharata, p. 15]. It's a tonic or fundamental *swara*. It is the basis of octave and other *swaras* can be located in reference to the *Vadi swara*. Once the *Vadi swara* is established the other *swaras* can be established accordingly.

Along with this description there is textual description defining the above-mentioned four qualities of *swaras* in terms of *Shadaj-Pancham Bhava*, *Shadja-Madhyama Bhava* and *Vivadi Bhava*. These *Bhavas* are understood in terms of *shruti-distances*. Very interestingly immediately after this description it is mentioned that `Thus after establishing *Vadi, Samvadi* and *Vivadi swaras*, all the remaining *swaras* are considered as *Anuvadi swaras*'. But first one needs to fix the position of a *Vadi swara* and then the position/s of *Samvadi swara*/s.

ययोश्च नवकत्रयोदशकमन्तरं तावन्योन्यं संवादिनौ‌| [Bharata, p. 15].

If the *shruti*-distance between two *swaras* is of nine *shrutis* or thirteen *shrutis* then these two *swaras* are *Samvadi swaras* of each other [Bharata, p. 15]. In reference to the *Vadi swara* then by using the rules mentioned in these *shlokas* two *Samvadi swaras* can be generated. *Swara-Sthapana* is a generative process in *Natyashastra*. Other *swaras* are also generated from the *Vadi swara* using these rules. Bharata also gives a description of valid pairs of *Samvadi swaras* (consonants). As per the prevalent tradition during Bharata's times, he has given a name-list of such pairs. Today one can say that there are more such pairs possible but in Bharata's paradigm these extra pairs were not considered. Bharata gives a list of valid pairs of *swaras* that qualify the above-mentioned rule of thirteen *shrutis* and nine *shrutis*. The description is as follows.

तद्यथा --- षड्जपञ्चमौ, ऋषभधैवतौ, गांधारनिषादवन्तौ षड्जमध्यमाविति षड्जग्रामे‌| मध्यमग्रामेऽप्येवमेव‌| षड्जपञ्चमवर्ज्य पञ्चमर्षभयोश्च अत्र संवादः‌| [Bharata, p. 15].

For example- *Shadja-Panchama, Rishabha-Dhaivata, Gandhara-Nishada, Shadja-Madhyama* in *Shadja Grama* is the valid pairs of *swaras* that adhere to the rule of consonance

(*samvadabhava*). Similarly in *Madhyama Grama* except *Shadja-Panchama* pair all the rest of the above-mentioned pairs is valid *Samvadi swaras* of each other [Bharata, p. 15].

अत्र श्लोकः ---

संवादो मध्यमग्रामे पञ्चमस्यर्षभस्य च | षड्जग्रामे तु षड्जस्य संवादः पञ्चमस्य च || [*Natyashastra:*28-23].

Here is a *shloka*- In *Madhyama Grama* there exists a consonance between *Panchama swara* and *Rishabha swara*. In *Shadja Grama Shadja-Panchama* are the consonant *swaras* of each other. This becomes the differentiating criterion for *Madhyama Grama* and *Shadja Gram* respectively. After describing consonant pairs of *swaras* Bharata defines dissonant *swaras* as follows. This descriptive list of pair of *swaras* is also a generative list of *swaras*.

विवादिनस्तु ते येषां द्विश्रुतिकमन्तरं... [Bharata, p. 15].

All *swaras* which are located at two-*shruti* distance from each other are called *Vivadi swaras* of each other [Bharata, p. 15]. This describes the rule of dissonance and again Bharata gives representative pairs of *swaras* that are dissonant to each other as follows.

तद्यथा--- ऋषभगान्धारौ, धैवतनिषादौ| [Bharata, p. 15].

For example-*Rishabha-Gandhara* and *Dhaivata-Nishad*a are the representative pairs of *Vivadi swaras* [Bharata, p. 15]. These are the two representative examples but the rule of two-*shruti* distance applies to all the *swaras* and their respective *Vivadi swaras*. Bharata is indicating that if the distance between two *swaras* is of two *shrutis* then all such *swaras* are *Vivadis* of each other. Later commentators like Abhinavagupta have followed it as a rule and applied it to all the *swaras* to decide their *Vivadi swaras* [Bharata, p. 18].

वादिसंवादिविवादिषु स्थापितेषु शेषास्त्वनुवादिनः| [Bharata, p. 15].

After establishing the *Vadi, Samvadi* and *Vivadi swaras* all the remaining *swaras* are called *Anuvadi swara* [Bharata, p. 15]. Bharata has not given the name-list of *Anuvadi swaras* however; the name-list of *Anuvadi swaras* provided by Mr. Ramakrishna Kavi is as follows [Bharata, p. 15].

अनुवादिसंज्ञकाः यथा--- *Anuvadi swaras* are understood as follows:

षड्जस्यर्षभगांधारधैवतनिषादाः (*Rishabha, Gandhara, Dhaivata* and *Nishada* are the *Anuvadi swaras* of *Shadja swara*.), ऋषभस्यमध्यमपञ्चमनिषादाः (*Madhyama, Panchama* and *Nishada* are the *Anuvadi swaras* of *Rishabha*.), गांधारस्यापि मध्यमपञ्चमधैवताः (*Madhyama, Panchama, Dhaivata* are the *Anuvadi swaras* of *Gandhara*.), मध्यमस्य धैवतपञ्चमनिषादाः (*Dhaivata, Panchama, Nishada* are the *Anuvadi swaras* of *Madhyama*.), पञ्चमस्य धैवतस्य षड्जमध्यमपञ्चमाः षड्जग्रामे| *Anuvadi swaras* of

Panchama are *Shadja* and *Madhyama* while *Anuvadi swaras* of *Dhaivata* are *Shadja*, *Madhyama* and *Panchama*. All these are the valid *Anuvadi swaras* in *Shadja Grama*.

मध्यमग्रामेऽपि (In *Madhyama Grama Anuvadi swaras* would be as follows.) मध्यमस्य धैवतनिषादर्षभषड्जगांधाराः (*Anuvadi swaras* of *Madhyama* are *Dhaivata, Nishada, Rishabha, Shadja*, and *Gandhara*.), पञ्चमस्य धैवतनिषादर्षभगान्धाराः (*Anuvadi swaras* of *Panchama* are *Nishada, Rishabha*, and *Gandhara*.), धैवतस्य षड्जर्षभगान्धाराः (*Dhaivata* has *Anuvadis* as *Shadja, Rishabha*, and *Gandhara*.), निषादस्य षड्जर्षभौ,षड्जस्यर्षभगान्धारौ॥ (*Nishada* has *Shadja* and *Rishabha* as *Anuvadi* while *Shadja* has *Rishabha* and *Gandhara* as *Anuvadis*.).

Here the word `sthapiteshu' is very important in the above statement. It suggests that the description of *swaras* and their qualities is aimed at establishing *swaras* on the *Veena* (musical instrument). Issue of establishing *swaras* in an octave has been very critical and debated by modern scholars as well. Since there is no explicit process of establishing *swaras* mentioned in the *Natyashastra*, scholars have been hesitant to fix the *swara* and *shruti* positions in an octave. Especially, the position of Bharata's *Rishabha* is very critical to establish the position of `Chyuta Panchama' that defines the `Pramana Shruti' and *Madhyama Grama*. However, in the absence of clear description of establishing *swaras* in the *Natyashastra*, scholars have postulated many diverse theories. However, the word `sthapiteshu' in the Bharata's text provides the clue. Accordingly the same description can be used as a guideline for establishing seven *swaras*. The detailed process of establishing seven *swaras* based on this description is outlined in the later part of this section. Meanwhile, Bharata summarizes the above discussion as follows.

तत्र वदनाद्वादि, संवदनात्संवादि, विवदनाद्विवादि, अनुवदनादनुवादीति| [Bharata, p. 15].

Thus *swara* that expresses by itself is known as *Vadi*. *Swaras* that are consonant to each other are called *Samvadis*. *Swaras* that are dissonant are called *Vivadis* and *swaras* that are *assonant* are called *Anuvadis* [Bharata, p. 15].

Vadi swara is the most powerful resonating *swara* and is having the most evocative power and plays a seminal role in music-making. The *Samvadi swaras* have secondary importance in music-making as compared to *Vadi swara*. *Samvadi swaras* can be used in important musical phrases depending on their relationship with the *Vadi swara*. *Vivadi swaras* also have important role as they can evoke softer emotions being very close to *Vadi*. *Anuvadis* are supposed to be used splendidly in the musical rendering depending on their association with the *Vadi swara*. They are supportive *swaras* and help enriching the impact of musical composition. Thus these four categories of *swaras* are very important in music. The *Vivadi swaras* are used tactfully. Their presence or absence helps enhancing aesthetic flavor of the rendering.

एतेषां च स्वराणां न्यूनत्वमधिकत्वं वा तन्त्र्युपवादनदण्डेन्द्रियवैगुण्यादुपलभ्यते स्वरविधान मेतच्चतुर्विधत्वमिति| [Bharata, p. 15]

Defects may occur in these relationships between *swaras* if there are defects in the frets, wooden body of the *Veena* or the faulty playing. Defect may also occur if the performer has some deformity [Bharata, p. 15].

This whole description is termed as `swaravidhana' (a comprehensive `statement' about *swaras*) in *Natyashastra*. So it appears that this specific description implicitly gives clues for establishing *swaras* in a *saptaka* (octave) since the term `sthapiteshu' (for establishing) is used there [Bharata, p. 15]. If we follow the above description in a step-by-step manner it should be possible to establish *swaras* in a *saptaka*. There are two possibilities. The first possibility is to establish *swaras* on a *Veena* having twenty two frets for twenty two *shrutis*. The second possibility is establishing *swaras* on a *Veena* having no frets. The first case is relatively easy but the second case requires musically sensitive ear to establish *swaras*. If we deal with the second case then it will be easier to understand the first case.

Accordingly, if we take a *Veena* having four strings, and tune the second string in such a way that it will produce the best possible sound which is not unwarrantedly low or high in pitch. For this experiment all the seven *swaras* can be established on the second string as described below. Then tune all the other remaining strings like a *Tanapura*, appropriately assuming that the second string stands for the middle *Shadja* of an octave. It's a common experience that a *Veena* or a *Tanapura* can be tuned to its natural frequency of that particular instrument. Each instrument has its own natural frequency depending on its material and its quality, length and dimensions of the instrument, quality and length of the strings used etc. By the above method one can tune the instrument to its own natural frequency. Once that is done, this natural frequency can be considered as a *Vadi swara*. This is also called *Amsha swara* because it is a tonic and acts as a basis for establishing other *swaras* as well as other octaves. Optionally one can choose any position on the string and consider that as a *Vadi* or *Amsha swara* as per Bharata's description. In this case *Vadi* and *Amsha* are the same (although the term `Amsha' is used in a wider sense by Bharata in the later part of *Natyashastra*).

The next statement gives the rule that *swaras* having nine-*shruti* distance and thirteen-*shruti* distance are *Samvadis* of each other. So once the *Vadi* is fixed on the *Veena*, one can always set two *swaras* on the *Veena* having nine-*shruti* distance and thirteen-*shruti* distance. These are the two *Samvadis* of the *Vadi swara*. The issue will arise that how to decide the nine-*shruti* distance and thirteen-*shruti* distance. It is done by using the aural sensitivity of ears. These two distances are so natural that if a person starts exploring on the instrument very quickly these distances will be noticed. For a trained musician it is an easy task. In the above description Bharata must have professional musician in mind and not a novice. So from a *Vadi swara* we get two *Samvadi swaras*. If the same rule is applied to

these two *Samvadi swaras* then two more *Samvadis* of these *Samvadis* will be generated. This also suggests the cyclical relationship between *Vadi* and *Samvadi*. This triggers a generative process since one can establish two *Samvadis* of these two *Samvadis*. This in turn becomes a cyclical method of establishing an entire octave. Abhinavagupta in his commentary on the above-mentioned description [Bharata, p. 15] says that internal distances or relationships among the positions of *swaras* form a `*Chakra'* a wheel or a cycle that makes an octave- a *swara mandala*. Earlier sages like Aangirasa and Kashyapa had demonstrated such a `*Parimandala'* or cyclical structure of *swaras* [Abhinavagupta in Bharata, p. 19].

तत एव स्थानान्तरे स्वरमंडलत्वमिति चक्रमुच्यते| तच्च परिमंडलं आंगिरसकाश्यपादिभिः मुनिभिः दर्शितम् | [Abhinavagupta in Bharata, p. 19].

Such a *Parimandala* (cyclical structure) is achieved only through appropriate relationships between *swaras* such as *Shadja-Madhyama Bhava* and *Shadja-Panchama Bhava* as discussed in next few paragraphs. This method may be termed as a `*Chakriya* Method' of establishing a *saptaka*. Although not mentioned in *Natyashastra*, by applying *Chakriya* method by using both the *samvada bhavas*: *Shadaj-Pancham Bhava* and *Shadja-Madhyama Bhava*, all the twenty two *shrutis* can be generated. Along with this, Abhinavagupta also says that there had been a common practice of establishing *Shadja* etc. *swaras* on *Veena* by using finger-widths as a unit of measurement and stretching the strings accordingly [Abhinavagupta in Bharata, p. 17].

वीणायांच षड्जादिस्थाने अङ्गुल्यन्तर पीडनपूर्वकम् अभिहन्यमाने तत्संपाद्यमिति व्यवहारः| [Abhinavagupta in Bharata, p. 17].

In the tradition this is called a method of `*angula pramana'* (measurement by width of fingers). Therefore, they might have a set measurement for establishing seven *swaras* in a *saptaka*.

There exists one more possibility. Once the *Panchama* and *Madhyama* are established then it was known that the aural distance between *Panchama* and *Madhyama* is of four *shrutis* as mentioned by Bharata. On this basis one can establish *Bharata's Gandhara* because the aural distance between *Madhyama* and *Bharata's Gandhara* is also of four *shrutis*. Once Bharata's Gandhara is established as discussed earlier the two-*shruti* distance is distinct and easy to recognize which is a `*Vivadi'* distance. So using this distance one can derive *Bharata's Rishabha* from *Bharata's Gandhara* because as mentioned by Bharata the distance between *Bharata's Rishabha* and *Bharata's Gandhara* is of two *shrutis*. Then by applying *Shadja-Panchama Bhava* one can derive *Bharata's Nishada* from *Bharata's Gandhara* and *Bharata's Dhaivata* from *Bharata's Rishabha*. Thus all the basic seven *swaras* of a *saptaka* can be established by using the above method. With a little variation in the

above description it is possible to generate all the Bharata's seven *swaras* in a step-by-step manner as follows.

1. First establish a *Vadi swara* on a chosen position on a string of the *Veena*.
2. By using *Shadja-Panchama Bhava* i.e. thirteen-*shruti* distance establishes a *Panchama swara* on the string.
3. By using *Shadja-Madhyama Bhava* i.e. nine-*shruti* distance establishes a *Madhyama swara* on the string.
4. By applying *Shadja-Panchama Bhava* to this newly generated *Madhyama* you also get the higher *Shadja*. The higher *Shadja* can be generated by various methods. It can be generated from the original *Shadja* by applying *Shadja-Shadja Bhava* also.
5. By applying *Shadja-Madhyama Bhava* or nine-*shruti* distance to the newly generated *Madhyama* one gets Bharata's *Nishada*.
6. From Bharata's *Nishada* it is possible to infer back to the Bharata's *Gandhara* by applying *Shadja-Panchama Bhava* or the thirteen-*shruti* distance.
7. Now with the help of *Vivadi Bhava* i.e. two-*shruti* distance to Bharata's *Gandhara* in a backward direction one can get the Bharata's *Rishabha*. Similarly, Bharata's *Dhaivata* can be generated by applying *Vivadi Bhava* to Bharata's *Nishada* in the same manner.

Thus in seven steps one can generate seven basic *swaras* by applying two *Samvada Bhavas* (rules of consonance) and the *Vivadi Bhava* (rules of dissonance). Bharata also says that by applying *Vivadi Bhava* to all seven *swaras* we get pairs of *Vivadi swaras*. It can be done in a following manner.

1. Apply *Vivadi Bhava* to Bharata's *Gandhara* to get *Antara Gandhara*.
2. Apply *Vivadi Bhava* to Bharata's *Nishada* to get *Kakali Nishada*.
3. Apply *Vivadi Bhava* to Bharata's *Madhyama* to get *Teevra Madhyama* or *Prati Madhyama* although Bharata has not mentioned about its use in the *jatis* or *ragas*. But this *shruti* is certainly generated and was a part of Bharata's scheme of an octave.
4. Apply *Vivadi Bhava* to Bharata's *Panchama* to get *Komal Dhaivata* which is also not mentioned by Bharata anywhere in the text.
5. Apply *Vivadi Bhava* to *Shadja* to get *Komal Rishabha* or *Dvi-shruti Rishabha* which is also not mentioned in the text.

Thus by applying *Vivadi Bhava* to Bharata's seven *swaras* we get five more *swaras* of which *Antara Gandhara* and *Kakali Nishada* are mentioned by Bharata and discussed their use in `*Jati*' music. By this approach we get total twelve *swaras*. Bharata considers all the remaining *swaras* as *Anuvadis*. Here again it is indicated that there exists a given set of twenty two *shrutis* using *Chakriya* method and by using *Shadja-Panchama Bhava* and

Shadja-Madhyama Bhava we select seven *shrutis* and call them *swaras*. Then by applying *Vivadi Bhava* to these seven *swaras* we select five more *swaras* making the total number twelve. All the other *shrutis* are called *Anuvadi swaras*. It means that out of the given set of twenty two *shrutis*, remaining ten *shrutis* are considered as *Anuvadi swaras*. However, even in the absence of *Chakriya* method, it is possible to establish *Anuvadi swaras* using *Shadja-Panchama Bhava* and *Shadja-Madhyama Bhava* that Bharata has not indicated.

Following is the step-by-step description of establishing Bharata's *swaras* on a specially designed *Shruti Veena* or *Shruti Sitar*. This *Shruti Sitar* is designed and developed by Dr. Vinod Vidwans to test and verify the *Sarana-Chatushtaya* experiment mentioned in Bharata's *Natyashastra*. The photograph of the *Shruti Sitar* is as follows.
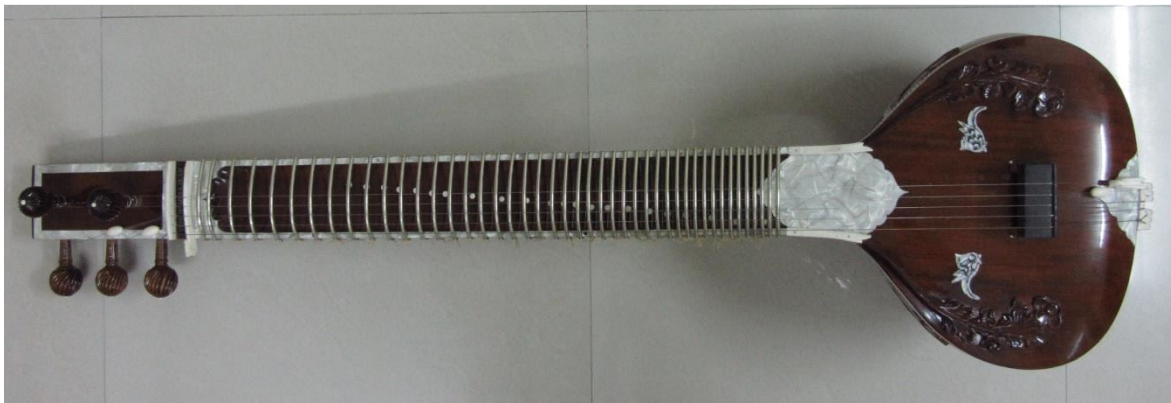
As already discussed, Bharata's seven *swaras* can be established in seven steps. However, following is a more elaborate process of establishing Bharata's seven *swaras*. There is a slight variation in this method as compared to the above method. The detailed illustrated description is as follows.
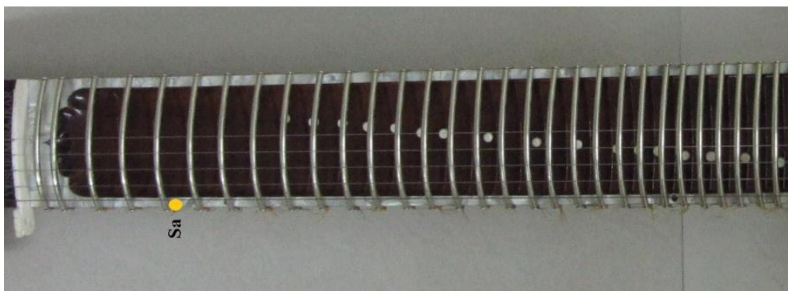

First establish a *Vadi swara* on a chosen position on a string of the *Veena*. In this case as per Bharata's description the *Vadi swara* is established on the fourth fret.
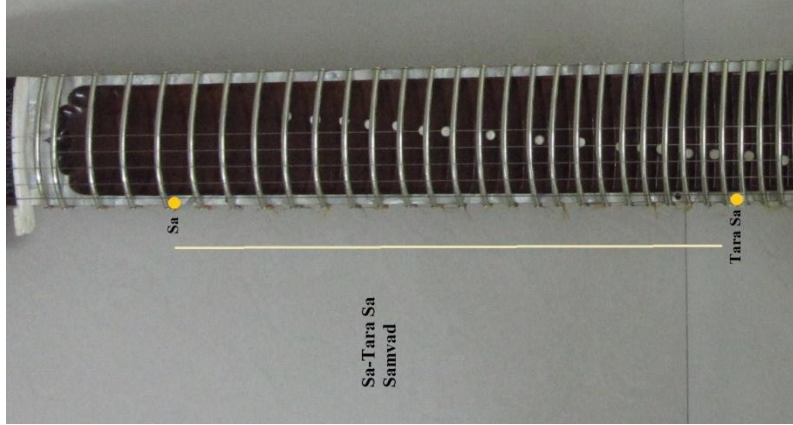
Establish *Tara Shadja swara* by using *Shadja-Shadja Bhava* or Sa-Sa consonance. This step is not very difficult because even a novice in music can easily notice this consonance.
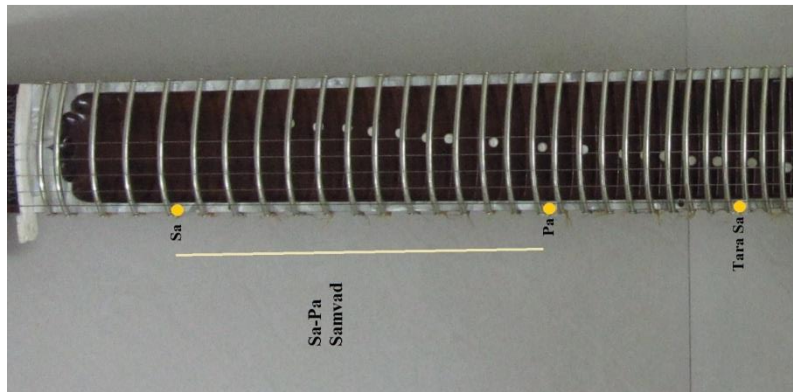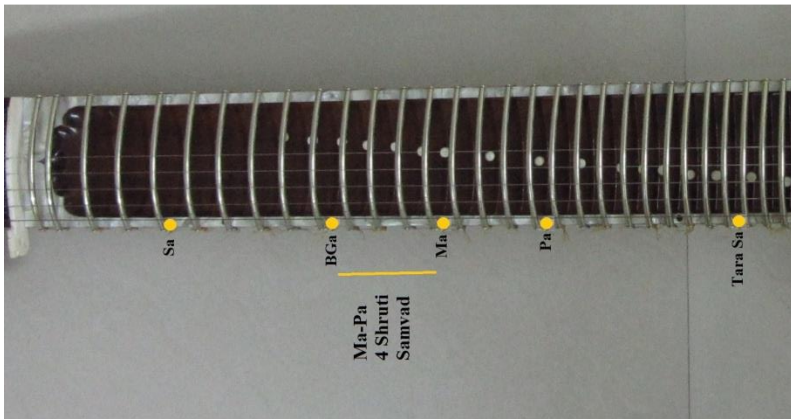

By using *Shadja-Panchama Bhava* i.e. thirteen-*shruti* distance establishes a *Panchama swara* on the string as shown in the above photograph.
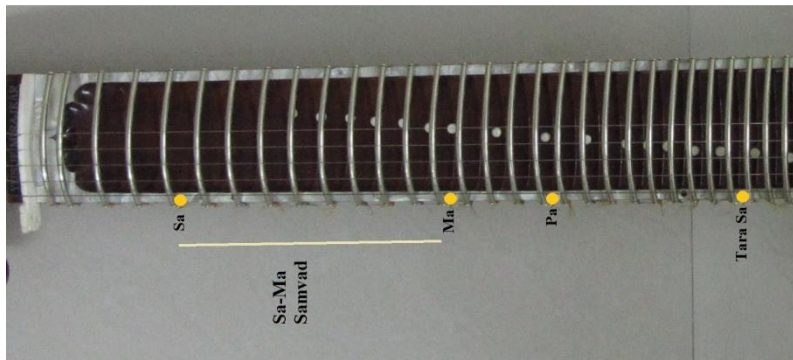

By using *Shadja-Madhyama Bhava* i.e. nine-*shruti* distance establishes a *Madhyama swara* on the string.
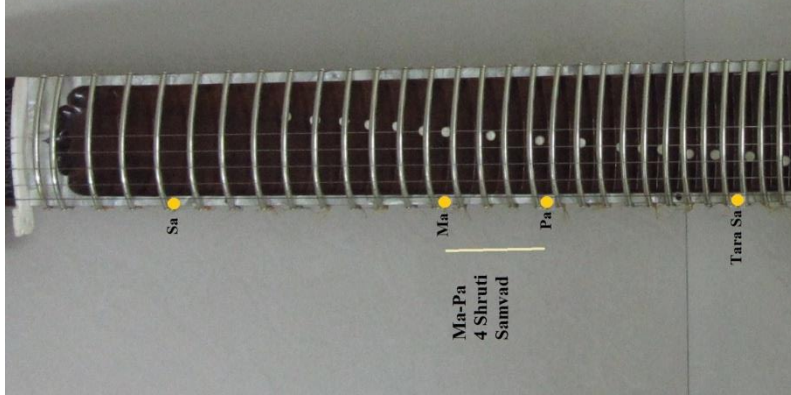
Then you get a *Ma-Pa* interval which is supposed to be of four *shruti* distance according to Bharata's description.


Now it is possible to establish Bharata's *Gandhara* on this basis because the interval between Bharata's *Gandhara* and *Madhyama* is of four *shrutis* according to Bharata.
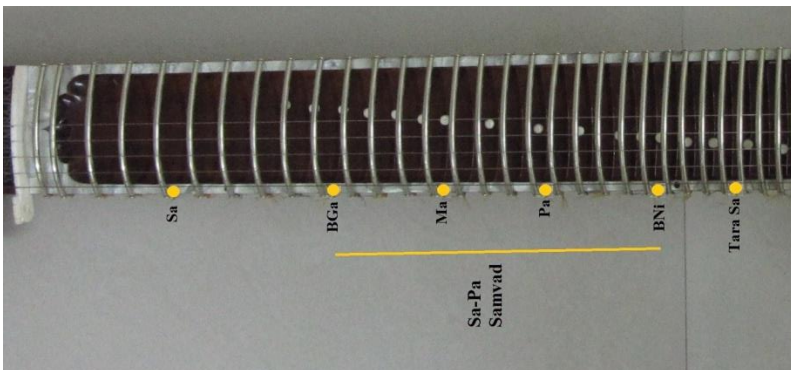

From Bharata's *Gandhara*, Bharata's *Nishada* can be derived by applying *Sa-Pa Bhava.* The next step is quite interesting.
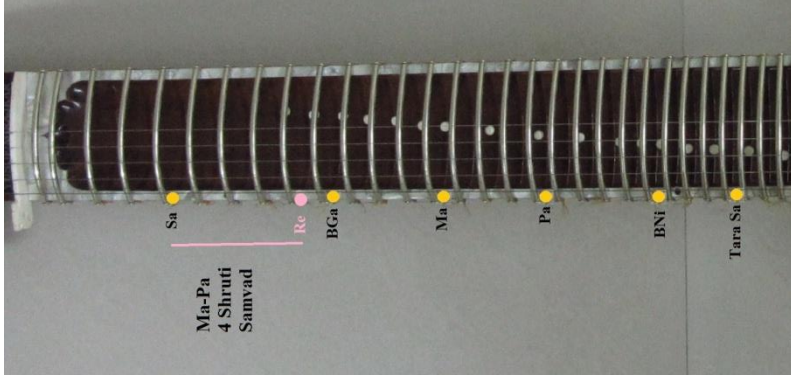
It is possible to establish *Chatuh Shruti Rishabha* by following *Ma-Pa Bhava* because it is four *shrutis* away from *Shadja*. So as an intermediate step *Chatuh Shruti Rishabha* is generated though it is not a part of Bharata's *Saptaka.* The next step is even more interesting.
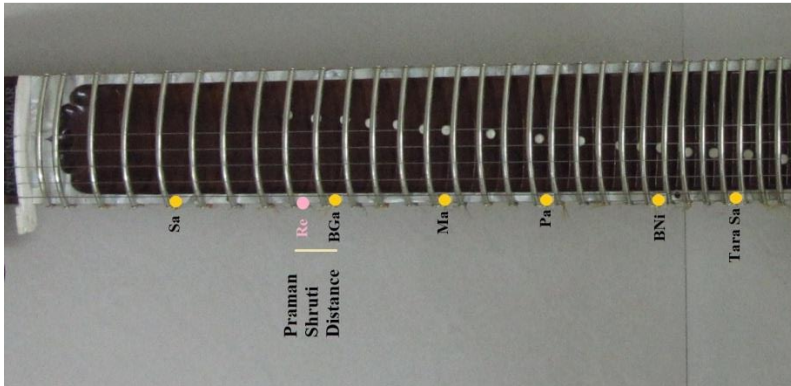

Interval between Bharata's *Gandhara* and *Chatuh-Shruti Rishabha* can be judged and experienced. It is one *shruti* interval. Using this interval Bharata's *Rishabha* can be generated as follows.
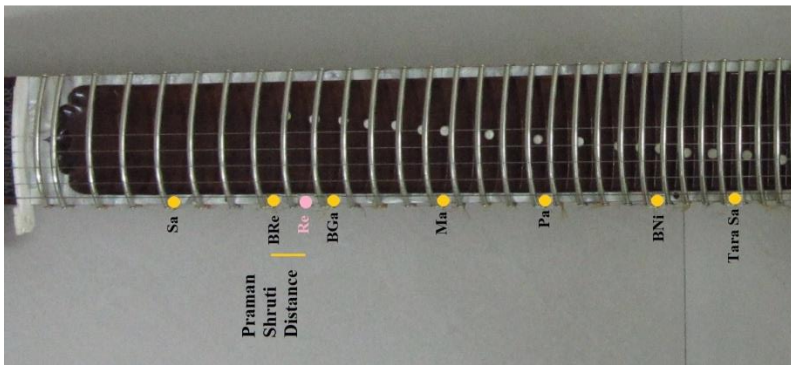

Thus *Chatuh-Shruti Rishabha* helps in inferring Bharata's *Rishabha* because the interval between Bharata's *Rishabha* and *Chatuh-Shruti Rishabha* is also of one *shruti*. As per the

description there is a two *shruti* distance between Bharata's *Rishabha* and Bharata's *Gandhara* and *Chatuh-Shruti Rishabha* falls exactly at the midpoint between them.
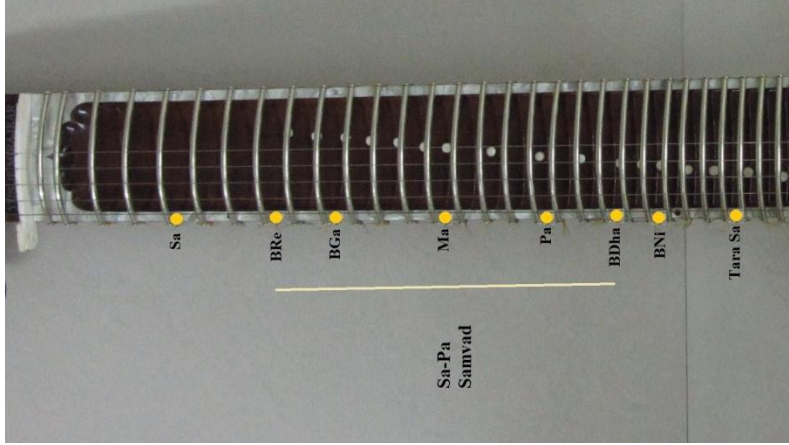
Since Bharata's *Rishabha* is generated, now it is possible to generate Bharata's *Dhaivata* by applying *Sa-Pa Bhava* as shown. So finally we get Bharata's seven swaras as follows.
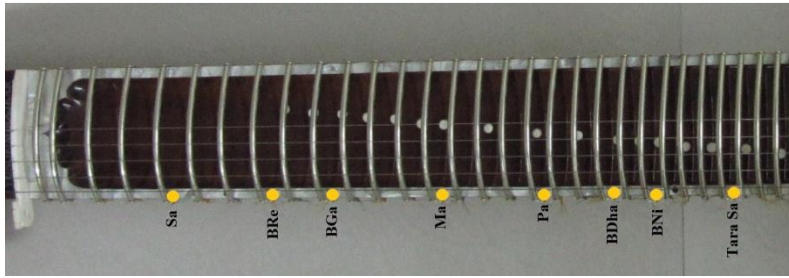
Thus Bharata's seven swaras can be generated as shown above.

Above mentioned detailed procedure clearly indicates that it is possible to establish Bharata's *saptaka* of basic seven *swaras* with minimum knowledge- *Shadja-Panchama Bhava* and *Shadja-Madhyama Bhava.* The *Panchama-Madhyama Chatuh-Shruti* interval is generated due to these two *Bhavas* after establishment of *Panchama swara* and *Madhyama swara* respectively. So in a way it's a self-generating mechanism. At the back of the mind, a musician needs to have tacit knowledge of *Shadja-Tara Shadja Bhava*, and *Vivadi Bhava* i.e., two *shruti* interval and the knowledge of *Pramana Shruti*. However, this tacit knowledge is not mandatory. Even without the tacit knowledge if one follows the above procedure meticulously then one can establish Bharata's *Saptaka* on the *Shruti Veena*.

As already discussed in previous paragraphs it is possible to establish Bharata's *saptaka* of basic seven *swaras* by following various approaches. The textual description is very helpful in this regards. As mentioned by Bharata in the text, with the help of *Shadja-Panchama Bhava* (thirteen-*shruti* distance), *Shadja-Madhyama Bhava* (nine-*shruti* distance) and *Vivadi Bhava* (two-*shruti* distance) it is possible to establish a *Saptaka* of seven *swaras*. In the

process five more *Vivadi swaras* are also selected. Remaining ten *swaras* are considered as *Anuvadi swaras.* Bharata calls this process as '*Swara-Mandala-Sadhanam'*. This also explains why *Vadi, Samvadi, Vivadi* and *Anuvadi swaras* are mentioned in that particular order in the *shloka*. They are stated in the same sequence because they are supposed to be used in that order to generate a '*swara mandala'* or a *saptaka*. It is worth mentioning that the whole process of establishing *Saptaka* is carried out using aural sensitivity of the musicians. Now it becomes quite crucial that such a process may not precisely match with mathematical formulations. If the same process is executed by mathematical formulation then the *swara* positions which are generated would be different. Contemporary musicologists understand '*Samvada Bhavas'* in terms of mathematical ratios: *Shadja-Panchama Bhava* as a ratio of 3/2, *Shadja-Madhyama Bhava*'s ratio of 4/3 and *Vivadi Bhava* as the ratio of 16/15 (semi tone) that give precise frequency values of the *swaras*. On the other hand if *swaras* are generated with aural sensitivity, they will not match these values exactly. It may be considered as mathematical approximation but from musical point of view since these *swaras* sound acceptable and musically pleasant to musicians it is certainly an aural perfection. During Bharata's times the mathematical ratios were not used for ascertaining the *swara* positions in a *saptaka*. On the other hand, as Sharangadeva also mentions in his *Sangita Ratnakar* that *swara* positions were established by aural sensitivity. The *Natyashastra* text is highly compact, compressed with cryptic meaning and very rich in content. Every word is used very carefully and carries definitive meaning. While understanding such *sutras* and each and every word of the text one needs to take utmost care while understanding and interpreting them.

References

Bharata (Date not known), *Natyashastra of Bharatamuni,* with the commentary-*Abhinavabharati* by Abhinava Guptacharya (Chapters 28-37), Vol. IV, edited by Kavi, M. Ramakrishna and Pade, J. S., Baroda: Oriental Institute Baroda, 1964.

Bhise, Usha R. (Ed.), (1986), *Naradiya Shiksha*, Original Commentary by Bhatta Shobhakara, critically edited with translation and explanatory notes in English by Dr. Usha R. Bhise, Poona: Bhandarakar Oriental Research Institute, Poona, India.

Brihaspati, Acharya (1986), *Natyashastra,* 28th Chapter -*Swaradhyaya*, (Hindi) with Sanskrit and Hindi commentary, New Delhi: Brihaspati Publication.

Narada (Date not known), *Naradiya Shiksha*, Original Commentary by Bhatta Shobhakara, Critical Commentary and Explanation in Sanskrit by Narayanaswami Dikshit, Edited by Satyavrat Sharma, Mysore: *Rajakiya Shakha Mudranalaya*, published in 1949.

Sharangadeva, Nishshanka (13[th]c. AD), Sangita *Ratnakar* (original Sanskrit text), translated by Taralekar, G. H. (Marathi Trans.), Mumbai: *Maharashtra Rajya Sahitya Sanskriti Mandala*, Published in 1975.

Vidwans, Vinod (2016), `The Doctrine of Shruti in Indian Music', Pune: FLAME University, Publication.