A Pratibha Spandan Journal

SWAR SINDHU
(National Peer-Reviewed/Refereed Journal of Music)
ISSN 2320–7175 (O) | Volume 13, Issue 02, July-December, 2025

TECHNICAL INPUTS & SCIENTIFIC IDEAS IN HINDUSTANI CLASSICAL MUSIC PRIOR TO THE ADVENT OF ELECTRICAL TECHNOLOGY

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ABSTRACT
Vedic Samgana is considered to be the origin of Indian music. However, this music has changed and evolved in many ways from the Vedic to the modern period. Over time, the cultural, socio-economic, geo-political and technological changes of each era have shaped the tradition of music in different way and created a rich musical heritage. Since the invention of electricity in the 19th century, technology has advanced by leaps and bounds. However, the pace of innovation is now much faster than in the past. Even three decades ago, it took a long time for a new technology to be introduced after a technology was discovered. But nowadays, if a technology is invented today, it becomes outdated in a very short time and new technology comes along. The use of technology in the field of music has also grown incredibly over the past 50 years. Before the advent of technology, the process of creating variations in the nature and quality of sounds produced by voices in music was a long habitual and laborious process. But today, due to drastic changes in audio technology, it is possible to create various effects of sound through digital processing of audio signals. With this, it is possible to not only influence the timbral effect of the voice, but also add ambient effects to the sound. As this advancement has many benefits, so many disadvantages are also observed in society. Technology is used in all the music we hear around us now. But just as some music becomes very pleasant to listen to, some music created through technology becomes very inaudible and painful. The main reason for this is the difference in their aesthetic content. And here lies the importance of dedicated learning. Despite all the advancements in music through technology, the importance of the traditional learning from a proper Guru for producing good music has not diminished at all. In other words, we should learn from the ancient traditions and not just run behind the advancement of technology. Only then will our society become better overall.

Keywords: *Technical Inputs, Scientific Ideas, Hindustani Classical Music*

Introduction

Nature is the oldest and genuine teacher of this universe. We are immensely grateful to Nature because not only did she give birth to us, but she also provided the logistics of survival to all living beings and essentially taught us how to survive in the face of her harsh forms. We see the reflection of this learning in the evolution of life and in order to survive in this, nature itself has evolved different skills within the living organisms. It means nature essentially installs those operational functions in living being as per their survival requirements. So we can say nature taught us first what technology is. In fact we can say that technology is nothing but the application of acquired knowledge in a scientific way for the purpose of development.

By learning this technology from nature and using it in all spheres of life, human has become the most advanced animal on earth today. Its use is everywhere in the development of human life. The application of technology is evident not only in fulfilling practical needs but also in satisfying the mental and spiritual thirst of people. And from that thirst, along with other aspects of life, people have mastered the technology of aesthetics, which is actually every art form. So we observe the same thing in the development of music, the greatest of all the arts. Greek philosophy says singing is the first form of speaking and history reveals three transitional phases in the evolution of singing speech, speech-song and singing (Durga, 2007, p. 11). Here in each phase of the development from singing speech to singing, there definitely should have some technological progress at the level of consciousness and physical perception. We can say therefore the evolution of music in the human voice is the first technological event for music guided by Nature.

Technology and Scientific approach in ancient time

Vedic Samgana is considered to be the origin of Indian music. However, this music has changed and evolved in many ways from the Vedic to the modern period. Over time, the cultural, socio-economic, geo-political and technological changes of each era have shaped the tradition of music in different way and created a rich musical heritage. From the ancient traces of the Vedic civilization we can understand that people of that age had reached a highest level of excellence in their cultural and intellectual life even in the absence of modern scientific discoveries and its sophisticated technological tools. In such musical traditions, numerous examples of scientific influence and application of technology can be cited.

Some instance of technical activity of that era

Observing various ancient musical instruments described in Puranas and various theories like origin of swaras, nadas etc. in ancient musical texts one can be ascertained about the application of technology and high level of scientific thinking in Indian music.

As such, about three thousand years ago, they constructed four types of musical instruments according to their types of origin of sound and classified them into -

Tata: Stringed Instruments

Avanadha: Percussion Instruments

Sushira: Wind Instruments

Ghana: Solid Resonators.

Scholars in ancient times had awakened their level of consciousness through musical pursuits and discovered many ground-breaking musical theories only through their auditory perception as well as they reached at many unique conclusions about the effects of musical sounds that have later been proven by modern scientific analysis.

Inventions like determining the position of Swara according to specific intervals and placing them on the strings of the Veena according to the nature, length, tension of the wire demonstrate the excellence of scientific and technical knowledge of the musicians of that era. Basically they made the Frets first.

Scientific approach in Indian music

Without the use of modern sophisticated scientific instruments, Bharata first introduced the '22 Shrutis' which is the maximum number of smallest and subtle intervals that a human ear can distinguish through its perception.

Another ancient scholar, Narada, introduced the concept of colour characteristics and family structure to the Swara system by considering them as a living entity that can be explained as a psychological manifestation of the tones of Indian music. In addition, Bharata also invented the theory of ‘Rasa’ to Indian music, which is essentially the emotional realization of the artistic expression of music. These apparently strange consideration typically emerged from an enhanced level of psycho-aesthetic analytical thinking that may cause an effect on arising multiple stimuli of a human body. The use of music therapy that we see in the human body these days is actually a comprehensive form of this psycho-aesthetic practice.

Later, in the early middle ages, we can find another important consideration in Hindustani classical music that is time theory of raga. The tune of a raga fixed at a particular time makes the mind aware of the essence of that particular time.

So we can say that technology is not always referred to in terms of mechanical or electrical or digital activity. It can be a manual practice at the level of consciousness or physical perception guided by scientific principles.

Technology in Hindustani Classical Music, prior to modern age

The form of Indian music has changed repeatedly since the Vedic age along with the cultural, socio-economic, and geopolitical changes in India. Historians in the field of music have analysed and explained the origin and development of Indian music through three different eras: Ancient, Medieval and Modern. The period from the Vedic age to the Gupta Empire is considered as ancient era, while the period from the 8th century to the 19th century is considered as medieval and the modern era continues from then until today. Now the period after the beginning of Islamic rule in the 12th century is generally considered as the post-medieval ages. It was during this period when Hindustani classical music as a new branch of Indian music was born and developed.

Since the establishment of the Islamic reign in India, Indian music has been heavily influenced by foreign influences. Until then, Indian music was being developed by indigenous musicians and was entirely influenced by internal influences. After the conquest of the whole of northern India by the Islamic rulers, two main genres of Indian music emerged. North Indian music was influenced by Persian culture and became known as Hindustani Classical Music and in the Deccan the Indian music tradition came to be known as Carnatic Music. Naturally, their approaches became completely different as the music styles grew up in two different cultures.

However, the context of the Hindustani Classical Music of this time was completely different from the previous era. During this period, sophisticated progressive classical music was sung and heard only in the royal court under the patronage of the king and in that context the courts were specially built. We see certain technical uses that became necessary for a musical environment and musical performance in that time.

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Technology used in Acoustical property of hall architecture

Historical accounts of this period suggest that musicians would perform in front of audiences of 100 to 200 people during their vocal performances and 30 to 40 for musical instruments (Raja, 2019, p. 51). Electricity had not been invented at this time and there was no electrical amplification system like modern time. In this situation, some architectural operations were undertaken in the construction of these palaces. That phenomenon is called acoustical architecture. Its properties are:-

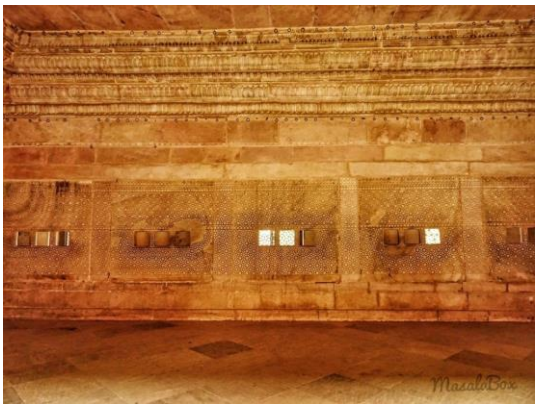
During this period, the most common feature in architecture like royal palaces was that they each had

Large dome-shaped roof for proper amplifying effect.

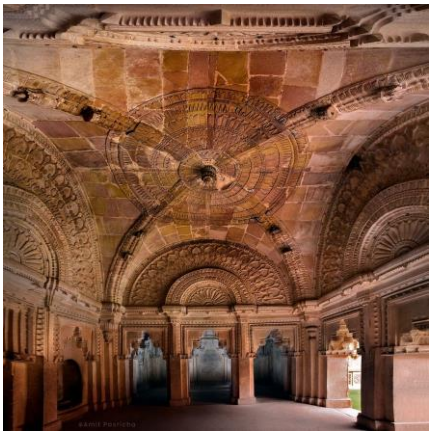
Large size room of a certain geometric shape (best at rectangular) allows for more predictable and even sound wave distribution, minimizing unwanted echoes and reflections.

Perforated wall or lattice window beneficial for sound absorption and diffusion due to their unique shape, which can help to scatter sound waves more evenly.

All these acoustic functions acted as factors to enhance the reverberation property of the hall as well as to control interior noise. If we take an example of Raja Man Singh Tomar's palace, which is now considered the only intact pre-Mughal palace in India (Lonely Planet). We can see that every architectural structure was designed with proper acoustic properties in mind.



Could have been music hall or temple. Windows for the royal ladies to watch the proceedings.

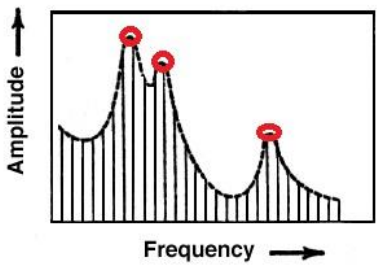


Hall in Maan Singh Palace

Voice culture and Properties of audibility

Absence of modern technology before the modern era one of the biggest challenges faced by Indian musicians was performing in front of large audiences. At that time there were no sound amplification systems like today that could extend the sound range and this was true for all types of music, whether it was open air or in an enclosed space. So the singers had to work on increasing the intensity of their voices. And softer musical instruments other than outdoor instruments like Sanai, Tasha, Nakara (Raja, 2019, p. 51) were played either with singing for accompaniment or as solo but in front of a small number of audience. Prior to the amplification era, musicians used some techniques to increase the audible range of their voices and performance.

Making Formants: - Hindustani classical music is dominated by melodies rather than lyrics. Different forms of this music have been established by various renditions of the melody over the ages. In singing vowels are naturally used more for the renditions. Notably in Hindustani classical music, an evocative, popular and emotional situation occurs during the performance of Khayal when both the performer and the connoisseur simultaneously meet in an emotional melting point called 'Pukaar'. At this stage of singing the vowels are applied purely to the melody and it is always sung at a high Pitch that denotes the high frequency of vibration. Interestingly, at this stage of singing, the volume or amplitude of the voice is the highest and therefore its intensity also becomes the highest. This is actually an instance of creating 'Formant'. In vocal singing, 'Formant' refer to specific frequencies that resonate within the vocal tract. It greatly shape a unique vocal characteristics and vowel production. In the absence of electrical amplification, prominent singers invented various methods of Riaz that had a significant impact on improving the resonant quality of the voice and making its sound louder.

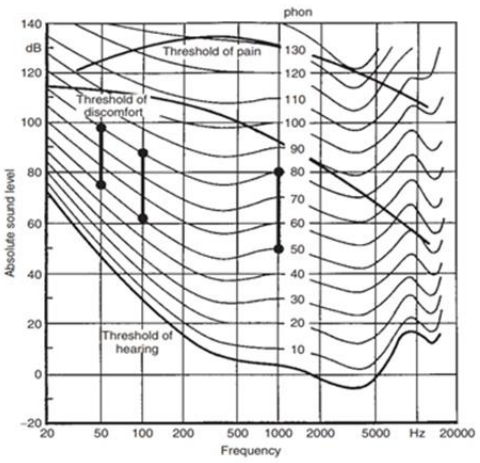


Picks are showing three formant regions

***Making compositions rhythmically clever**:* - When one understands how sound works then it can better understand its parameters and can control or work on them. Sound energy propagates in wave form by vibrating the air particles around us. The stronger the energy pulse, the greater the distance it can travel and can more sustainable in the environment. In the pre-amplification era, compositions for the Sitar and Sarod were rhythmically clever because melodic artistry would not reach the listener. Here we see the same phenomenon mentioned earlier. A rhythmic composition creates frequent beats which creates frequent energy pulses but the melodic expansion is competitively weak. That's why early 20th century music was heavy on stroke craft and dazzling speed of execution.

Contemporary famous vocal artist Ustad Faiyaz Khan specialised this feature in his singing style. He was very famous for his bold and robust voice as well as his rhythmic compositions. These characteristics of his singing style and voice certainly brought an advantage in terms of audibility.

Singing on a higher scale: - Analysing the characteristics of hearing on the Equal Loudness Curve we find a scale refers to human audibility that's called 'Phon' scale. According to the scale human hearing is not directly related to amplitude of sound or sound pressure level (dB). It depends on the frequency too. But these two dependencies are not symmetric in nature. In between a certain range under the same sound pressure level if frequency gets higher then audibility also becomes higher. So singing on a higher scale can make a singer more audible. Prior to the 19th century, singers handled the problem of no amplification system by singing on a higher scale.



Equal Loudness Curve

Spatial Positioning of performers: - They had also known about the directional property of sound according to its propagation. According to that the musicians and singers arranged their sitting position during the performance at the Royal court. In general, in Hindustani classical music, we still follow almost the same arrangement during vocal performances that is: a singer in the middle, tanpuras (drone instruments) on either side of the back, and a percussionist on one side in front and a melody player on the other. This results in a balanced combination of sound spreading all around. In the terminology of modern sound technology, this phenomenon is called 'Spatial properties of sound'.

Conclusion

Since the invention of electricity in the 19th century, technology has advanced by leaps and bounds. However, the pace of innovation is now much faster than in the past. Even three decades ago, it took a long time for a new technology to be introduced after a technology was discovered. But nowadays, if a technology is invented today, it becomes outdated in a very short time and new technology comes along. The use of technology in the field of music has also grown incredibly over the past 50 years. Before the advent of technology, the process of creating variations in the nature and quality of sounds produced by voices in music was a long habitual and laborious process. But today, due to drastic changes in audio technology, it is possible to create various effects of sound through digital processing of audio signals. With this, it is possible to not only influence the timbral effect of the voice, but also add ambient effects to the sound. As this advancement has many benefits, so many disadvantages are also observed in society. Technology is used in all the music we hear around us now. But just as some music becomes very pleasant to listen to, some music created through technology becomes very inaudible and painful. The main reason for this is the difference in their aesthetic content. And here lies the importance of dedicated learning. Despite all the advancements in music through technology, the importance of the traditional learning from a proper Guru for producing good music has not diminished at all. In other words, we should learn from the ancient traditions and not just run behind the advancement of technology. Only then will our society become better overall.

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