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SCIENTIFIC VIEW OF THE SOUTH INDIAN AND NORTH INDIAN PERCUSSION INSTRUMENTS

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ABSTRACT

In percussions instruments, mud, wood or metal of that type is used, which has wide empty space. As a result of the air pressure, artists can present various rhythm patterns both with soft deep sounds according to their will. The question is how these instruments were made in ancient times. "Necessity is the mother of invention" hence the instruments were made according to the needs. The musicians and instrumentalists of those times, perhaps, had the necessity of percussion instruments for accompaniment and they were not fully satisfied with the rhythmic sounds produced by striking wood and metal pieces. Perhaps reverberations of his own sound in deep caves or the sound of the chirping of birds on hollow trees might have led man to infer that the hollowness of the barrel helps to a great in magnifying the sound. This research paper mainly focuses on types of Percussion Instruments and their variations in Carnatic and Hindustani Music. To Explain this in detail, I have introduced South Indian and North Indian Percussion Instruments.

Keywords: Mridangam, Tabla, The five tones, Harmonic relationship, Superposition.

INTRODUCTION

Indian musical instrument is as old as its musical tradition and culture. This fascination is passionately encased into the poetic and mythic imagination of the Indians and is reverberated amidst the fervour of folktales, fables, myths and legends. Indian musical instruments thus have a rich time Tandava line. In fact when Lord Shiva as the epitome of the creator, destroyer and sustains danced the then each pounding beat of his Damaru (the small drum Lord Shiva holds in His hand) alternated the forces of darkness and light. The terrible yet awe-inspiring, passionate yet fierce sound of the Damaru is said to be the origin of the concept of the musical instrument. Mythology asserts that Lord Shiva, the lord of dance, gifted humanity four instruments; the Veena, the Venu, the Damaru and the Mridangam. This indeed connotes that these might have been the primordial parent instruments. That was just the beginning of the journey of musical instruments in India as a devotional offering and accompaniment of music.

DESCRIPTION OF THE INSTRUMENTS

An immense variety of drums of various forms and shapes are to be found in use in different parts of the country. [1] The musical drum, however, stands apart in a class by itself, and is used exclusively for high class chamber music where the noise of an ordinary percussion instrument would be intolerable. The classical form of the instrument known as the Mridangam is a two-sided drum which is played with both hands. Its shape resembles that of two truncated cones or flower-pots placed together end to end with the narrow ends outwards. The construction usually takes the form of a hollow wooden shell of the shape mentioned with both ends open over which the drum-skins are stretched. To enable the drum-skins to be

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tightened to any desired tension, and at the same time ensure a uniform tension in all directions, the following device is adopted. The drum-hands are firmly attached to circular hoops by interlaced thongs of leather. The hoops are then put over the ends of the drum. A long band of lather repeatedly passes through both the hoops and to and fro over the full length of the drum, in all exactly sixteen times at equal intervals along its circumference. The ends of the leather band are then tied together. The tuning of the drum is roughly effected by lightening up the leather cord by adjusting the position of 8 movable cylindrical blocks of wood over which it passes.

The final adjustment is made by the strokes of a hammer which force down the hoop over which the drum-head is stretched to the extent desired.[2] The arrangement enables the drum-head to be accurately adjusted to any desired tension, and what is equally important enable the tensions in different directions to be equalised with meticulous precision. One can travel from one end of India to the other and seek in vain for a Mridangam which has either more or less than sixteen tightening straps. It is clear, therefore, that the inventors of the drum not only realised the importance of equalisers namely, sixteen. A part from the details mentioned above, the special feature of the Mridangam consists in the construction of the drum-head played with the right hand. As originally put on, the drum-head is not a single piece of leather, but consists of three layers of drum-skin superposed on each other. In the final stages of construction, all the three layers except one are taken out leaving only rings round the margin to reinforce one drum-skin which is left intact and is capable of vibration. Externally one such ring of leather is visible over the drum-head. The latter is then loaded symmetrically with a firmly adherent composition which is said to consist of finally divided iron-oxide mixed with charcoal, starch and gum.

The laying on of this composition and making it firmly adherent are elaborate processes which take a great deal of time. Actually, the composition is put on layer and pressed down by rubbing with a smooth piece of stone or metal. The thickness of the layer is greatest in the centre and shades down towards the margin. In some cases, it is found that the thickness is stepped down by three, five, or seven stages towards the margin. Watching the process of putting it on, it is found that the thickness and distribution are determined by testing the tone of the drum continuously as the work proceeds.

The left-hand drum-head of the Mridangam is usually larger in size than the right-hand one. It is constructed in a similar manner to that described above, but without the central loading. In playing the instrument, however, the left-hand drum-skin is loaded with a piece of dough (kneaded wheat-flour) which is moistened and put on in sufficient quantity towards the centre to bring the pitch down to the desired value.

A Modern variant of the Mridangam is known as the Tabla.[3] This really consists of two drums placed simultaneously with the right-hand and left-hand respectively. Both consist of wooden or metal shells open at one end only and covered with drum-skins. The drum-head of

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the Tabla played with the right-hand is very similar to that of the Mridangam. The drum played with the left-hand has a firmly adherent composition which is, however, unsymmetrical placed on the membrane. The purpose of such unsymmetrical loading is quite different from that of the symmetrical loading use in the right-hand drum, with which alone we are concerned in the present paper. The tension arrangements in the Tabla are similar to those in the Mridangam with the difference that the tightening cords simply pass round the closed end of the Tabla. The number of tightening straps is exactly 16 as in the Mridangam. In some very recent forms of Tabla, the tightening is effected by 16 iron rods placed at equal intervals round the drums, each having a hook which goes over the circular hoop of the drum-skin and is provided with a tightening nut and bolt at the lower end. With this arrangement again it is possible to adjust the tensions very accurately to equality in all directions.

THE DESCRIPTION OF THE MRIDANGAM AND TABLA

The Mridangam and Tabla given above is sufficiently comprehensive to cover all cases met with in practice. It must not be imagined, however, that all instruments going by these names are exact copies of each other. This is far from being the case.[4] The individual examples differ notably in the size and shape of the wooden shell used, as also in the nature of the wood itself and the thickness of the shell. Notable differences also occur in thickness of the leather used for the drum-skin, in the exact area and distribution of the central load, and specially also in the width of the marginal ring of the leather which is left superposed on the vibrating drum-head. In some forms of Mridangam or Tabla, the marginal ring is left very wide. In others, it is cut down to the barest minimum.

DIFFERENCES BETWEEN CARNATIC TALA AND HINDUSTANI TALA

- The Carnatic System has 7 basic Talams. These are Ada, Dhruva, Eka, Jumpa, Matya Rupaka and Triputa. The Hindustani system has approximately 12 widely used tals – mainly the Tintal, Jhoomra, Tilwada, Dhamar, Ektal, Jhaptal, Keherwa, Rupak, Dadra, Chowtal, Chachar and Sitarkhani.
- The Sam is depicted by the symbol + in Hindustani system, but doesn't have a particular symbol in the Carnatic system.
- The Carnatic system has about 16 angas. The most common are the laghu, Dhrutam and anudhrutam shown by the symbols l, 0 and U. Anudhrutam has 1 aksharakala, Dhrutam has 2 aksharakalas and laghu has the possibility of upto 5 kinds of Aksharakalas ranging from 3, 4, 5, 7, 9 depending upon the jaati of the tala. (aksharakalas meaning the number of taps used). These aksharakalas can further be divided into 'nadais' which determine the number of beats contained in each aksharakala. These are again of 5 types- 3, 4, 5, 7, 9- tisram, chatusram, khandam, mishram, sangeernam.The Hindustani tala's beats are known as tali and khali- Each tali is numbered beginning with 2 , 3 and so on. The first is written as +. The khali is an emphasized beat shown by the wave of the hand and written by the symbol 0. In

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Carnatic system, 0 is dhrutam having 2 beats marked by a clap and a wave. Hence, the angas of the two tala systems are different and have different beats and symbols assigned to them.The rests in Hindustani system are marked by *. The rests in Carnatic system are written as .and ,

- The syllables used in both are quite different. In Hindustani, the syllables used are dha, ga, dhi, ge, dha, ka, ti, na, tun, tin, terikita, te. The syllables used in Carnatic are ta ki ta, ta ka di mi, ta ki ta taka di mi, ta ka ta ki ta and ta ka di mi ta ka ta ki ta. For takita, tajunu may also be used, for taka, jhunu may be used too.
- The speeds in Hindustani system are called Vilambit, Madhya and Drut. The speeds in Carnatic system are called Vilambam, Madhyamam and Dhritam. These are slow, medium and fast.
- Hindustani system has some exceptional tals or fractional tals expressed in terms of an integer and a fraction. They usually contain a grouping of 1 and a ½ beats at the end of the cycle. Some examples are ArdhaJaital, UpaDasi and Sawaritals which contain 2 or more groupings of 1 ½ matras, causing an irregular pattern. The Carnatic system also has irregular talams. They have no angalakshanam and are played with irregular taps. They have no laghu, no jaati, no nadai. only maatras exist in them. These are known as Chaapu talams. They are of 4 types- Tisra chapu talam 3+3=6 matras, Khanda chapu talam 5+5=10 matras, Misra chapu talam 7+7=14 matras, and Sankeerna chapu talam 9+9=18 matras.
- The Carnatic system has about 175 talams .The Simhanandatala is the longest Carnatic talam. The Hindustani system has about 350 tals.
- The concluding part of a 3 cycle rhythmic ending in Hindustani system is called Tihai, whereas in Carnatic system it is called Teermaanam.
- In Carnatic music, the yati, or decorative mathematical pattern is used as an important technique and is a hallmark of this particular music system. There are 6 major yatis:

    a. GoputchaYati

    b. SrotovaahaYati

    c. DamaruYati

    d. MridangaYati

    e. SamaYati

    f. VishamaYati

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In Hindustani music also, the yati is used although the place of yati in Hindustani music is very limited.

This is the overview is a short layman's approach to knowing the broad categorization of the Hindustani and Carnatic Tala systems of India. Of course, as we delve deeper into either of them, their understanding and evolution becomes more complicated and in depth.

south indian mridangam north indian tabla

ITS ACOUSTIC CHARACTERS

The most striking feature which distinguishes the Mridangam and the Tabla from other forms of drum is the sustained character of the tones. This is evidently the result of two features in the construction, namely, the heavy wooden shell on which the drum-head is stretched and the symmetrical loading of the latter by a firmly adherent composition. A drum-head which is stretched on a frame of small mass is obviously incapable of prolonged vibration, owing to the rapid communication of movement to the supporting frame.[5] The heavy rigid shell in the Mridangam or Tabla, on the other hand, is favourable to the sustained vibration of the drum-head. The loading of the drum-head greatly increases the energy of vibration and is therefore a factor which favours the emission a sustained tone. The presence of the enclosed air within the shell is probably also a factor tending in the same direction.

It is empirically observed that the width of the marginal ring of leather superposed on the drum-head has a notable influence on the duration of tone. The ring in fact acts as a kind of damper, and its width is adjusted to obtain the desired kind of tone. With a broad ring, we obtain a renamed tone of short duration in which few overtones are present, while with a narrow ring, the tone is prolonged and is also brighter, containing more overtones. From these observations, it is to be inferred that the purpose served by the marginal ring is mainly to suppress high notes which are not desired.[6] The mechanism of such suppression is not difficult to understand. It is well known that in the case of a circular drum-head, the amplitude of vibration is relatively greatest towards the centre in the case of lower tones, but increases relatively towards the margin in the case of higher overtones having several nodal diameters. The leather ring, therefore, acts as a damper for these high overtones without sensibly influencing the lower tones. Too broad a ring, however, carries the suppression to an

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undesirable extent, cutting out even the tones of lower pitch. As will be seen later in paper, the construction of the drum-head seeks to arrange the firs! Nine normal modes of the membrane into a harmonic sequence of the five tones. The existence of normal modes of still higher pitch can only serve to injure the final result, and their elimination may therefore be described as the purpose of the marginal ring. The latter cannot greatly affect the pitch of the graver tones in as much as the amplitude of vibration is rather small for such tones towards the margin, and the effect of the marginal ring considers as a load must therefore be unimportant. The contact between the ring and the drum-head is probably imperfect, and this should tend to make the ring act as a damper rather than a have much is common, are by no means identical in their acoustic properties. In the playing of the Mridangam, the flat of the hand is used more frequently, while with the Tabla, the finger tips are usually employed.

THE FIVE TONES OF THE DRUM

- The sustained character of the drum makes it possible to excite and observe them very readily. Indeed, one of the host striking properties of the harmonic drum is the any desired mode of vibration may be excited by simple percussion quit as easily as a stretched string may be caused to vibrate in one or other of its harmonic modes by touching it at a nodal point and plucking it suitably.[7] The analogy is indeed very close as will be presently made clear. The gravest mode of vibration of the drum-head is, of course, that without any interior nodal lines. This is best excited by bringing down the quickly removing it. Produced in this way, the deep hum-tone obtained is quite free from overtones, whereas the tone obtained by striking the drum with the finger tips contains overtones.

- The second tone of the drum-head is that having one nodal diameter. The professional drummer excites this by smartly striking the membrane with the edge of his palm laying his little finger along a diameter so as to bring it to rest, while the edge strikes the membrane and rapidly recoils from it. A clear sustained tone is obtained in this way. That the membrane thus excited vibrates with one nodal diameter at rest is readily demonstrated by strewing a little fine sand on it either before or immediately after the stroke, The sand gathers itself into a clear-cut straight line along nodal diameter coinciding with the position of the little finger in striking. For the success of the experiment, one has, of course, to cultivate the professional touch in the manner of striking the drum. It is also very important to adjust the tensions of the membrane in different directions to equality with great care. If this is not done, the experiment succeeds only if the drum is struck along the nodal diameter having the greatest or the least tension. When struck along a diameter with an intermediate tension, beats are heard, and the nodal diameter as indicated by the send rotates to and fro about the centre periodically. If the beats are very fast, the sand is visible only as a little pile at the centre of the drum-head.

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- There is another method of exciting the mode of vibration with one nodal diameter which is very simple and does not need any professional skill. This is merely to touch the membrane gently with one finger of the lift-hand along a diameter near the margin, and to strike the membrane smartly with a finger of the right-hand at a suitable point on the perpendicular diameter. The finger touching the drum determines the position of the nodal diameter which is indicated by the send forming a line across the drum-head. For exciting the third tone of the drum by itself, the simplest method is to touch the membrane gently with the fingers at two points near each other in the edge of the black central load and then strike the drum smartly with the finger at a point removed 90 away; a clear ringing tone is obtained, and if the two points touched are at a suitable distance apart, two parallel nodal lines stretching across the drum are formed by the sand the significance of this form relatively to the usual modes of vibrations of a circular drum-head will be considered later.
- The fourth tone of the drum is similarly excited by touching the edge of the loaded area lightly at three points, and striking the drum near its outer edge smartly with the finger at a point 90" away from the middle of the three points touched. If the three parallel nodal lines stretching across it, the position of with is indicated by the lines of the sand.[8] A clear ringing tone is heard at the same time. The fifth tone may similarly be excited by touching the edge of the loaded area at four points, and striking the drum smartly at a appoint some distance away on the marginal ring of leather. Except in large and specially well-made instruments, the duration of this tone is rather small, and it is not quite so easy to obtain its sand figures by percussion as in the case of the graver tones.
- The harmonic relationship between the five tones of the drum is readily appreciated when they are excited one after another in the manner described above. It will be noticed that, the fundamental corresponds to the drum-head vibrating as a whole. The second harmonic corresponds to the drum-head vibrating in two equal parts separated by a nodal diameter. The third harmonic corresponds to a mode of vibration in which the drum-head divides into three parts separated by two parallel nodal lines. The fourth harmonic corresponds to a mode in which the drum-head divides into four parts separated by three parallel nodal lines. The fifth harmonic similarly corresponds to a case in which the drum-head vibrates in five parts separated by four nodal lines. The analogy with the simple case of a vibrating stretched string is thus remarkably close

SUPERPOSITION FIGURES OF THE THIRD HARMONIC

We have now to consider the relationship between the normal modes of vibration of the drum-head and the series of harmonic tones given by it.[9] As regards the first and second harmonics, no special remarks are necessary as the modes of vibration are unique in each case. The third harmonic on the other hand, is produced by a combination, in ant desired ratio of amplitudes, of the modes of vibration of the drum-head with one nodal circle, and the

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mode with two nodal diameters. The proof of this statement is very easy and is illustrated in figures 7to12. It depends on the fact that by touching the drum-head gently at suitable points and exciting it by percussion, the mode of vibration with one nodal circle, and desired ratio of amplitude. In either case, the pitch of the tone obtained is identical, but the superposition gives rise to nodal diagrams which are observed as sand figures and assume varying shapes.

The mode of vibration with one nodal circle is most readily obtained by touching the drum-head at some little distance from its centre with the tip of a pencil, and tapping the centre with a light hammer. If the point of damping has been suitably chosen, a nodal circle is obtained. If it is too near or too far from the centre, an elliptic sand figure is found. To obtain a very elongated ellipse, we touch two points which are very close to each other on the edge of the loaded area and strike the drum with the finger at a point removed from them by 90'. On increasing the distance between the two points touched, the ellipse straightens out and we obtain two parallel nodal lines running across the drum-head, and dividing it into three parts of which the middle has a smaller area than two outer ones.[10] On further increasing the distance between the two points touched, the nodal lines curve outwards and assume the form of hyperbolae. Finally, when two points 90" apart on the edge of the loaded area are damped with the fingers and the drum is struck at the mid-point of the adjacent quadrant, we get two nodal diameters passing through the centre.

SUPERPOSITION FIGURES OF THE FOURTH HARMONIC

The fourth harmonic is given by the drum-head vibrating in one or other of two forms: (a) mode with one nodal diameter and one nodal circle, (b) a mode with three nodal diameters, or by superposition of both these forms. This is demonstrated by the sand figures reproduced as figures 13-18. Most of the figures for the fourth harmonic are obtained by touching three points on the edge of the loaded area and tapping the drum with the finger just on the inner edge of the marginal ring of leather.[11] If the three points touched are exactly 60" apart from each other, we get the mode of vibration with three nodal diameters. If they are closer together but at equal distances the diagram takes the form of three lines, one of which is a diameter running across the drum-head and the other two are hyperbolae curved outwards. As a special case, we have the figure consisting of three parallel straight lines running across the drum. All these figures are evidently obtained by the superposition of the normal two modes mentioned above. To obtain by itself the mode with one nodal diameter and a nodal circle, the devices is adopted of touching the loaded area at two point's 90" apart, one at the edge of the loaded area and the other on the nodal circle itself and of tapping the drum-head near its edge.

SUPERPOSITION FIGURES OF THE HARMONIC

From the fact that to be fifth harmonic is obtained when four on the drumhead are damped, it may be inferred that it is from a superposition of at least two modes, namely, (a) one with four nodal diameters only, (b) one with two nodal diameters and a nodal circle.[12]

Experiments made at Calcutta in 1919 with a fine large Mridangam showed that in reality we have also a third mode superposed on the above, namely, the mode with two nodal circles only. By touching the drum at suitable points, it was found possible to excite any of the foregoing three modes by itself, and obtain the relative sand figures, the pitch of the modes being the same in all the three cases. If it is possible to excite the drum in sustained vibrations of this frequency, a grate variety of superposition figures should evidently be capable of being obtained.

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