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SHAPE & TUNING OF SOME WIND MUSICAL INSTRUMENTS

1. Previous statements

The musical technical treatises reserve particular spaces to the instrumental typologies, spaces that usually seem to obtain only a marginal interest from the scholars.¹

Sure, if we consider that, for lack of a notation system comparable to the western one – besides the fact that iconography doesn't offer a great help,² it is, at least, problematic to hypothesize the real form than the type of sound characteristic of this or that instrument described in the texts.

Remains, however, an extremely interesting space reserved to the technical indications connected to the form and to the dimensions of the instruments and to the technique of sound production.

1. As we will see in the following texts, chosen by specific interest of their contents, the parts destined to the instrumental technology, even if shorter than the traditional ones – exposing *svara* and *rāga*, for instance – are not so destituted of importance. Only as an exemple, we can consider Ram Avtar “VIR”, *Learn to on flute*, New Delhi 1978. However, even the literary essays, within a reasonably large bibliography, count only a circumscribed number of titles concerning instrumental typologies. (see note 2, below).

2. K. Krishna Murthy, *Archaeology of Indian musical instruments*, Delhi 1985; B. Chaitanya Deva, *Musical instruments of India*, Delhi 1978 (1987); S. Krishnaswamy, *Musical instruments of India*, Delhi 1965 (1967).

This is the primary aim of the following exposition, done on the exam of some passages taken from the *Nāṭyaśāstra*³ the *Rasakaumudī*⁴ and the *Saṅgītadāmodara*,⁵ sustained by other pas-

3. For the *Nāṭyaśāstra* in general, cfr. R. Perinu, *La musica indiana*, Padova 1983, pp. 22 and 38-39, note 6; S. Piano, *Letteratura sulla musica e la danza*, in: G. Boccali, S. Piano, S. Sani, *Le letterature dell'India*, Torino 2000, part II, *La tradizione, la nuova rivelazione e la letteratura scientifica*, p. 354; for the text, I used the following editions: a. *The Nāṭya Śāstra* ascribed to Bharata-Muni, vol. II, (Chs. XXVIII-XXXVI), the original Sanskrit text with Introduction and Various Readings from MSS. and printed texts by Manomohan Ghosh Calcutta 1956 (in particular, chap. XXX, pp. 38-39); ID., vol. II, translation, Calcutta 1961, chap. XXX, pp. 50-52; b. *Nāṭya Śāstra of Bharatamuni*, with the Commentary *Abhinavabharati* by Abhinavaguptacharya, vol. IV, chaps. 28-37, ed. by K.L. Joshi, Delhi-Ahmedabad 1984; chap. XXX, pp. 235-245; c. *The Nāṭya Śāstra* of Bharatamuni, translated by a board of scholars, Delhi s.d.; chap. XXX, pp. 414-415.

4. For the *Rasakaumudī*, I used the following edition: Śrīkaṇṭha, *Rasakaumudī*, ed. by A.N. Jani, Baroda 1963. For what concerns the Author and his work, it is basic the *Introduction* to the text edition, by A.N. Jani, pp. 1-90. Clear textual evidences suggested by the editor of the text allow to affirm that Śrīkaṇṭha, a brahman by birth, was a court-poet of the king Jāma Sattarsal, who reigned over Saurāṣṭra, in Navanagara, near Dvārāvati, from 1569 to 1608. The date of *Rasakaumudī* could be the 1575, as it is suggested by some of the contents, for instance the use of the *mela* in classification of the *rāga* – instead of the *rāga-rāgiṇī-putra* system, employed in North India –, the tuning of the *viṇā* mediated from Puṇḍarīka Viṭhāla and Rāmāmātya, but above all by the use of *rāga mukhārī* as basic tonal scale, *rāga* that theoretically divides carnic system from hindusthani one [Cfr. ŚRK, II, 79]. With regard to, are illuminating the studies of P.K. Gode, quoted by A.N. Jani in the Introduction to the work, that we list here in succession: P.K. Gode, *Date of Śrīkaṇṭha and identification of his patron Śatruṣalya with Jam Sattarsal of Navana-gara (1569-1608 A.D.)*, in ABORI, XII; ID., *Some further light on the date of Śrīkaṇṭha, the author of the Rasakaumudī*, in ABORI, XIV. The treatise is articulated in ten chapters, all called *adhyāya* except the second, defined *viveka*, for 1175 *śloka*. However, only the chapters from the first to the fourth – *svara*, *rāgaviveka*, *prabandha*, *vādyā* – treat specifically the music. The other six are of various contents and cover from *nṛtya* to *praśamsa*, from *rasa* in general to *śṛṅgāra* in detail, from seasons to *rājāniti*: of course, Śrīkaṇṭha was a court-poet, bound to the art world and, above all, to his patron. Besides, we have to consider the arrangement of the first four chapters: first, the *svara*, from which *rāga* is formed; after, compositions (*prabandha*) and, last, instruments for musical execution. The instruments, gathered in the fourfold classification, expressly assigned to Bharata *Nāṭya Śāstra* (cfr. ŚRK, IV, 5a: “*Bharatādayah*”). However, of the 190 verses that form the chapter IV, 178 are dedicated to *avanaddha* – and to the necessary *tāla* for the execution – and *ghana*. Only the eleven final verses concern flutes or wind instruments in general. The chordophones are totally avoided, because the specific tractation of the *viṇā* is done in the chapter dedicated to the *rāga*.

5. For the *Saṅgītadāmodara* (The [text of] *Dāmodara* about music), I used the following edition: Śubhaṅkara, *Saṅgītadāmodara*, ed. by G. Sastri, – G.

sages taken from the *Amarakośa*,⁶ the *Pañcamasārasaṃhitā*⁷ and from the *Saṅgītaratnākara*.⁸

However, just to give the right beginning to my exposition, I think it is indispensable to clarify a basic concept.

The general term for “wind instruments”, *suśira*, is translated with “hollow”. Now, Monier Williams and Benfey explain the term as formed by *su+* *sīra* [or *śīra*], explaining it as a “cane or tube”; Monier Williams sees it connected to the root *SR̥*, related with the Greek *ormé*, *ormão*, *ama*, *allomai* and with the Latin *salio*; Benfey, instead, underlines the fact that the term would be *śuṣ + irā*, from which *śuṣa*, “hole”.⁹

Mukhopadhyaya, *Calcutta Sanskrit College Research Series* n. XII, Calcutta 1960. The Author was a bengali or assamese brahman who lived between the end of XVth century and the beginning of the XVIth. The work is organized in five *stavaka*, probably the result of a fortuitous collation, given the improbability of the series of displayed subjects. In chapter V, *śloka* 192a, are listed the nouns of the Author’s four sons, last of which is precisely Dāmodara, thing that explains the title, otherwise not clearly understandable.

6. For the *Amarakośa*, I used the following edition: *Amarakośa*, III voll., Madras 1971-1983, with the unpublished south indian commentaries *Amarapadavivṛti* of Liṅgasūrin and the *Amarapadaṭṭā* of Mallinātha.

7. For the *Pañcamasārasaṃhitā*, I used the following edition: Nārada, *Pañcamasārasaṃhitā*, ed. by Bipin Singh, Calcutta 1984. The text is equipped with three different translations: in *hindi*, by Lalmani Tiwari, in *bengali*, by Deepa Dasgupta; in *manipuri* by Khumallambam Rasbehari Singh.

8. For the *Saṅgītaratnākara*, I used the following edition: Śārṅgadeva, *Saṅgītaratnākara*, with *Kalānidhi* by Kallinātha and *Sudhākara* by Śimhabhūpāla, ed. by Pandit S. Subrahmanya Sastri, Madras 1943-1953; I also looked up at the partial following english translations: a. *Saṅgītaratnākara* of Śārṅgadeva, translated into English with detailed notes by C. Kunhan Raja, vol. I – Chap. I, Madras 1945; b. *Saṅgītaratnākara* by Śārṅgadeva, Sanskrit Text and English Translation with comments and notes; vol. I, *Treatment of svara*; english translation by R.K. Shringy, under the supervision of Prem Lata Sharma, Delhi 1978; vol. II, Chaps II – IV, english translation by R.K. Shringy, under the supervision of Prem Lata Sharma, Delhi 1989 (1996).

9. M. Monier-Williams, *A Sanskrit-English Dictionary*, Oxford 1899 (1956) (1960) (1964), p. 1238, col. 1; Th. Benfey, *Sanskrit-English Dictionary*, Delhi 1982 (Reprinted from the first german edition of the 1866), p. 958, col. 1. Cfr. also N. Stchoupak – L. Nitti – L. Renou, *Dictionnaire Sanskrit-Français*, Paris 1932 (1972), p. 854, col. 2, under voice *su+śira*: “*nt. trou, cavité*”; and V. Sh. Apte, *The Practical Sanskrit-English Dictionary*, Delhi 1965 (1975) (1978) (1985), p. 994, col. 3, always under voice *suśira*: “*nt. a hole, an aperture, a cavity*”. Cfr. AK, *cit.*, I, 8, 4b.; “*vaṃśādikaṃ tu suśiraṃ...ll*” and the Commentary: “*suśiḥ randhramasyāśīti suśiram*”, where *suśiḥ* is well translatable with “*hole of a cane*”; cfr. also ID., *cit.*, I, 9, 1-2.

Really, a tube is hollow by definition and so the accent is put on the presence of the holes and not on the hollowness of the tube itself.

Now, if we consider, besides all what we said till now, the interesting hindī translation of Nārada's *Pañcamasārasaṃhitā*,¹⁰ one can see that the definition is connected with “*chidra...vādyā*”, that is to instruments which sound is obtained by means of holes practiced along a tube.

And again, if one considers that any tube, in which one blows in a proper way, produces a sound, we have to precise the current definition of *suśira*, as hollow, adding that “*hollow*” is the tube, the inside of which – if the original material is wood (but about this we will discuss soon) – has been *emptied*. That is, *hollow* is an adjective showing the quality, the peculiar nature of the examined object, but not its function. So, *hollow* is the inside of something, in which, in this particular case, must be air: but since it is that – and only that – allows sound production, the accent is put on the external content, on the tube, rather than on the inner content; on the external content because it is its essence to be *holed* that consents the production of the musical sound.

At this point of my exposition, I try to suggest a translation of the term *suśira* just a little more precise than the traditional one: instead of simply *hollow*, I think it is better *hollow tube*.

It is also normal that the holes should be practiced till a very precise interval, according to an operative technique, the observance of which is the *condicio sine qua non* for the correct intonation of the instrument itself.

Some further precise statements about it, do not seem useless to me.

In all wind instruments, the sound is modified from the grave note to the high one: similarly to what happens on the chordophones, where the touching of the strings, cutting the length, produces a sound more acute, the opening of the holes, one after another, shortens the length of the air column, contained in the tube, and gives a sound ever and ever more high.

10. NPsS, *cit.*, comm. to II, 18b: “*chidrayukta vādyā vaṃśī...*”, where *chidra* means “*containing holes, pierced*, as explains M-W, *cit.*, p. 406, col. 3. Cfr. ŚSRSub, *cit.*, VI, 4-5, and, particularly, the commentaries both of Kallinātha and Siṃha-bhūpāla. Cfr. also the AGBh, at BhNŚ, XXX, 1: “*vastutas chidrātmakasuśirābhiviyaktasvaraviśeṣarūpatyaivāśyopayoga*”.

The quality of the sound or, if we prefer, the timbre of the instrument, depends from the used materials, from the length and the section of the tube, and from the kind of the mouthpiece.

About materials and shape of the instrument, we will treat in the following part of this exposition. Now I would like to consider the kind of mouthpiece.

First of all, we have to remember the classical tripartition of wind instruments: *flutes, reeds, mouthpieces*.

Leaving aside reeds and mouthpieces, we must examine only the flutes. Their structure is articulated in two kinds: recorders or direct-flutes and transverse flutes.

In the first ones, the sound is produced blowing in a mouthpiece done with a particular technical device that makes the sound to break against a reed, which makes impossible any variation of volume.

Instead, in the second ones, the mouthpiece is found near to the head of the instrument, which is stopped, in such a way that the air blown inside of the tube strikes the stoppage and comes back towards the end of the instruments, opened to allow different variations of the volume without changing the correct tuning.

However, in the first ones, the *recorders*, also called “*soft*”, the timbre is more pleasant, richer of harmonics – caused by the breaking of the air on the reed –; in the second ones, that transverses, more plain, but also more firm.¹¹

II. Materials

Admitted that wind instruments are relative to the *Gandharva*, as we know from the *Pañcamasārasaṃhitā* of Nārada,¹² the employed materials go from the woods to the metals, from the ivory to the horn.

Let’s start with the woods ones.

11. V. Gai, *Il flauto*, Ancona 1975. Cfr. the reprint of the important musicological treatise by J. Hotteterre, Le Romain, *L’art de préluder sur la flûte traversière, à bec, avec aubois et les autres instruments de dessus*, Paris 1966.

12. NPsS, *cit.*, II, 19b: “...gandharvāṇāṃ tu sauṣiram”.

The *Saṅgītadāmodara*, IV, 52b-53a,¹³ lists four principal kinds: they are, in the first place, the cane (*vaiṇava*), the *khadira*, the red sandal (*raktacandana*) and the normal (*śrīkhaṇḍa*); to that must be added, according to the *Rasakaumudī*, IV, 182a,¹⁴ the *tvaksāra* and the *śiṃśapā*. Sometimes, the botanical species isn't easily identifiable, but it remains an incontrovertible fact: the makers of wind instruments knew how to use a sufficiently large number of woods able to produce a high melodious kind of sound, as, on the other hand, happens also nowadays. All that foresees, obviously, expertise relative to those parts of a plant that must be chosen preferring them to others – which venation is less suitable to the sound – and to the seasoning of the wood itself. Unfortunately, instead, nothing is said about the kind of paint that was used on the instrument, indispensable work not only from an aesthetical point of view.

13. ŚSD, *cit.*, IV, 52b-53a: “*vaiṇavaḥ khādiro vā 'pi raktacandanajo'thavā || śrīkhaṇḍajo 'tha...!*”; M.V. Macrì, *Lexicon phitonimicon*, vol. I (a-au), Torino 1988, pp. 72, 117; ID, *ibid.*, p. 141, where *susira* is translated with “cane”. It would be of some interest to consider that, in Sardinian language, the terms *abenas*, *benas* – clearly related to Latin or Italian *avena* (term of preindoeuropean derivation) – show a wind instrument of particular musicological interest. The connection with our discussion is: in Sardinia, the little canes of this cereal are still used to make tenuous whistles. Cfr. G. Dore, *Gli strumenti della musica popolare della Sardegna*, Cagliari 1976, p. 67; F. Calonghi, *Dizionario latino-italiano*, Torino 1950 (1962), vol. I, p. 319, cols. 1-2; G. Devoto, *Avviamento alla etimologia italiana*, Firenze 1966 (1968), Milano 1979, p. 36; M. Cortelazzo-P. Zolli, *Dizionario etimologico della lingua italiana*, V vols., Bologna 1989, vol. I, p. 95, col. 1. Cfr. also M. Monier-Williams, *cit. Dict.*, resp. pp. 1021, col. 2; 336, col. 3; 861, col. 2; 1099, col. 1; Th. Benfey, *cit. Dict.*, pp. 905, col. 2; 244, col. 1 (only for *vaiṇava* and *khadira*); L. Renou, *cit. Dict.*, pp. 697, col. 1; 220, col. 2, 595, col. 1; 743, col. 1; Apte, V. Sh., *cit. Dict.*, pp. 890, col. 2; 392, col. 3; 791, col. 1; 931, col. 2.

14. ŚRK, *cit.*, IV, 182a: “*tvaksāraśiṃśipā...*”; cfr. M.V. Macrì, *cit.*, p. 132, only for *śiṃśipā*, *cit.*, however, as *śiṃśapā* and identified as *Dalbergia Sissoo* or *Jonesia Asoka*; cfr. also M. Monier-Williams, *Dict. cit.*, p. 463, col. 3, for *tvaksāra*, identified as *bamboo*, *Laurus Cassia* and *Bignonia Indica*; and p. 1069, col. 3, for *śiṃśipa*, considered a w.r. for the more correct *śiṃśapā*, identified as *cit. Macrì* does; N. Tschoupak, *Dict. cit.*, p. 295, col. 1, in which *tvaksāra* is identified with *bamboo* and, ID., *ibid.*, p. 727, col. 2, for *śiṃśapā*, identified as “...l'arbre *Dalbergia Sisu*”; for this last term, cfr. also V. Sh. Apte, *Dict. cit.*, p. 916, col. 3, where the term is identified as “the *Asoka tree*”. Regarding the paints used on the wind instruments, I must to point out that anyone of them is used, except a normal wood wax, differently to what appens to string instruments, where they are absolutely indispensable both for the sound and the maintenance.

There are other indications referring to the avoiding shapes of the woods.

The *Rasakaumudī*, IV, 183a,¹⁵ for instance, says that are to avoid wood materials that are *sarala* (straight) or *ślakṣṇa* (thin) and that with not uniform venations. The *San̄gītadāmodara*, IV, 52a¹⁶, besides, talks about suitable qualities of the woods, that would be round (*var-tula*), straight (*sarala*), with only a knot or better in only a part (*eka-parvan*) and therefore devoid of that kind of imperfections (*doṣavivar-jita*) that can alter the quality of the sound.

Following the exam of the materials, one gets further important information.

Once established that the list of the types – about which I will explain after – doesn't do any distinction among flutes, reeds and mouthpieces, they are listed some metals and, in the end, the ivory.

Metals¹⁷ are gold, silver, copper and brass, each of them adapted to the construction of the flutes, where one considers that, at least in the Western, the mouthpieces are put together under the collective denomination of “brass”. However, since the employment is extended also to the the ivory, one may think not only and not so much about the whole instrument, but to the fact that some verbal expressions taken from the cited texts – as, for example, *vinirmita*, *śodhita*, *śilpavidyapraṇīṇā*, on the one hand, and *manohara*, *raṅgaja*, on the other –¹⁸ seem to indicate that only these materials are employed as ornaments, either of aesthetical kind (gold and silver), to connect, making them beautiful, the different parts of which a wind instrument is made; or of a technical kind (ivory) to strength the holes of the instrument, which diameter, in the use, can be altered by the friction of the nails of the musician.

15. ŚRK, *cit.*, IV, 183a: “*vaṃśastu saralah ślakṣṇo vranāgranthīyādivarjitah*”.

16. ŚSD, *cit.*, IV, 52a: “*var-tulah saralaścaikaparvā doṣavivarjitah*”.

17. ŚSD, *cit.*, IV, 53ab: “*...sauvarṇo dantidantamayo'thavā | rājatastābhrajo vā'pi paitalo..*”.

18. *Vinirmita*, ŚRK, 182b; *śodhita*, *śilpavidyāprāṇīṇā*, *manohara*, ŚSD, IV, 54ab; *raṅgaja*, ID, *ibid.*, 53b.

III. Types

Now we can start with the typologies, keeping in mind that the list, that one can obtain from the texts here examined, doesn't offer any clarifications about differences among flutes, reeds or mouth-pieces (in accord with the threefold partition above said) and that the only way to understand the inner distinction (the typologies of which are all largely present in the instrumental practice of today) remains the exam of the materials.

In fact, if one considers the list of the *Saṅgītaratnākara*, VI, 11ab-12a,¹⁹ one sees that the winds – nine in number –, besides the *vaṃśa*, eventually made of cane, as we can well understand from the name itself,²⁰ are gathered in the following eight types:

pāvā, pavikā, muralī, madhukarī, kāhalā, tuṇḍukinī and cukkā; and finally, śṛṅga and śaṅkha.

In particular, this last one is joined to the term *-ādi*,²¹ that permits us to presume the existence of others of the same nature: not so much flutes, or eventual mouthpieces, but horns and conchs.

The named list becomes richer of other elements in the *Saṅgīta-dāmodara*, IV, 50a-51a,²² in which, in addition to those named, we

19. ŚSRSub, *cit.*, VI, 11ab-12^o: “*vaṃśaḥ pāvāḥ pāvikā ca muralī madhukaryapi | kāhalā tuṇḍukinyau ca cukkā śṛṅgamataḥ param || śaṅkhādayaśca vādyasya suṣira-sya bhidā matāḥ !*”.

20. Macrì, M.V., *cit.*, p. 121. Cfr. also A, *Dict. cit.*, p. 823, col 1; B, *Dict. cit.*, p. 804, col. 1; M-W, *Dict. cit.*, p. 910, col. 1; R, *Dict. cit.*, p. 620, col. 1. It could be interesting to compare the previous citations with BhNS [BhNSGh, Txt, p. 39], XXX, 1a, where, referring to the general category of *suṣira*, is used the adjective *vaṃśakṛta*, “made of bamboo”; equally interesting the notes to BhNSBS, p. 415: “...bamboo is the most common material for flute. Hence the name *vaṃśa* for the flute also”.

21. ŚSRSub, *cit.*, VI, 12a: “*śaṅkhādayaśca...*”.

22. ŚSD, *cit.*, IV, 50ab-51a: “*vaṃśo'ṭha pāri madhurī tittirī śaṅkhakāhalā | toḍahī muralī vukkā śṛṅgakā svaranābhayaḥ || śṛṅgaṃ kāpālīka vaṃśaścarmavaṃśastathāparaḥ ||*”. For what concerns the presence of the term *kāpālīka*, could be of some interest to hypothesize a relation between the use of this particular kind of instrument and some sect tied to the practices of the *yoga*. Remarkable the term *carmavaṃśa*, in which we have to note the connection between *carman* – skin – and *vaṃśa* – bamboo cane, that consents to presume, above all, one bag, as happens for bagpipes. However, since the use of the bag is not essential to the maintenance of the air pressure – see the technique of the Sardinian wind instrument called *launeddas*

find *pārī*, *madhurī*, *tittirī*, *toḍahī*, *svaranābhi*, besides a *kāpalikā* and a *carmavaṁśa*, at least surprising – because there are no other information about them.

Usually, perhaps, the only possible position concerning the above named list, which doesn't consent other sustainable illations for what concerns the typologies that could be recuperated from the meaning of each term – because none of them can be correctly translated – is that to remain strictly connected to the text of *Rasakaumudī*, that says: “among the wind instruments, the *vaṁśa* is considered the best of all in absolute”.²³

That is to say that, besides the list, what one can obtain, at least according to the actual musicological cognitions, is that the rules concerning this or that instrument – perhaps the single denominations could be clear end meaningful for the users of that period – have gone lost and are now not being used.

It seems to be more constructive to rest, at least, in the field of more concrete prescriptions.

Let's continue to examine the XXX chapter of the *Nāṭyśāstra*, lapidary composed of thirteen verses. It begins so: “The instrument made of reed is called ‘furnished with holes’”, since, in translating the term *suṣira*, we have keep in mind the interpretation of the term proposed before.²⁴

A little bit further, the text does an affirmation that could consent us to say that a flute must be thought and realized in a certain way in order to obtain the correct relation between the notes of the scale.²⁵

[cfr., G. DORE, *cit.*, pp. 37-66] and the australian diggeridoo – it could be even of an instrument made of many sections, joined together by skin articulations.

23. ŚRK, *cit.*, IV, 181a: “*suṣireṣu samagreṣu vaṁśaḥ śreṣṭhatamaḥ smṛtaḥ*”.

24. BhNŚGhTxT, *cit.*, XXX, 1a, p. 39: “...*suṣira*...”; cfr., even if only a title of reference, BhNŚGhTr, *cit.*, XXX, 1a, p. 50; BhNŚJ, *cit.*, XXX, 1a, p. 135; BhNŚBs, *cit.*, XXX, 1a, p. 414.

25. BhNŚGh, *cit.*, XXX, 1ab: “*ātodyaṁ suṣiraṁ nāma jñeyaṁ vaṁśakṛtaṁ budhaiḥ | vaiṇe eva vidhistatra svaragrāmasamāśrayaḥ*”.

The problem of the translation arises from the term “*vaiṇa*”, a clear *samdhī* modification for *vaiṇe* or *vaiṇas*: its meaning is “a maker of bamboo-work”, as we find in M-W, *Dict. cit.*, p. 1021, col. 2 [Cfr. also AP, *Dict. cit.*, p. 890, col. 2; B, *Dict. cit.*, p. 905, col. 2; R, *Dict. cit.*, 697, col. 1]; really, the term is related to *veṇu* and not to *vīṇā*, as it is clearly said in the above cited Dictionaries [Cfr., for all, M-W., *Dict. cit.*, p. 1014, col. 2]. Therefore, I

In fact, if the reference to *svara* and *grāma* shouldn't be understood in this way, one ought to ask why, immediately after, are described three types of production of the *svara* on the *vaṃśa*, while in the preceding chapters, about string instruments, there isn't any mentioning about the technique of sound production; not only, but the three types of sound production indicated for the *vaṃśa* are clearly being used only on an instrument made by a tube furnished of holes and not on a chordophone.²⁶

We can now see how is the discourse about sound production in the *Nāṭyaśāstra*. The v. 2ab says: “*The svara of the vaṃśa are constituted of two, three, four śruti [respectively] obtained with [the technique of] the beating (kampana or kampita), [of] the half opening [of the hole] (ardhamukta) and [of] the total opening (vyaktamukta)*”.²⁷

The v. 6ab²⁸ clarifies that “*is of four śruti a svara [obtained by the movement of] a finger that frees completely [the hole], of three śruti [if the svara] is obtained with beating*”; to the v.7a,²⁹ the text concludes explaining that “*the svara [produced by the movement] of a finger that frees half a ho[le] are of two śruti.*”

So for the *madhyama grāma*. For that of *ṣaḍja*, the text, to the v.

try to suggest a translation of this verse interpreting the term *vaiṇa* as “flute-maker”. So, in my opinion, the verse is better translate in the following manner: “*even in [the work of] the flute-maker [it is established] a relation between svara and grāma*”. Going a little further in my reasoning, I must underline that the term is always masculine, observation that makes very difficult the relation with the string instrument, that is the *viṇā*, always feminine, on the contrary. However, I must point out that, at the v. 3a, the term *vaiṇa* appears another time and that, in this case, the translation doesn't do what is suggested above. In any case, whatever the correct translation could be, we met a particular term that is very interesting.

26. BhNŚGh, *cit.*, chap. XXIX; ID., *ibid. cit.*, XXX, 2b: “*kampamānārdhamuktāśca vyaktamuktās...*”: these are the three ways of sound production and they could be referred only to an instrument with holes; in effect, even if the first term (*kampamāna*) and the third (*vyaktamukta*), could be connected to a string shaken or free, the second one, meaning “half open”, can't be related to a string, since it is impossible to imagine an “half open” string.

27. BhNŚGh, XXX, 2ab: “*dvikatrikacatuṣkāstu jñeyā vaṃśagatāḥ svarāḥ | kampamānārdhamuktāśca vyaktamuktāstathaiva ca ||*”.

28. BhNŚGh, 6ab: “*vyaktamuktāṅgulitatra svaro jñeyaścatuṣśrutiḥ | kampamānāṅguliścaiva triśrutiḥ parikīrtyate ||*”.

29. BhNŚGh, XXX, 7a: “*dviko'rdhāṅgulimuktastu evaṃ śrutyāśritāḥ svarāḥ ||*”.

8ab³⁰, says “*ṣaḍja, madhyama and pañcama [are produced by the movement that] opens entirely [the respective holes]; dhaivata and ṛṣabha by the movement of the respective fingers that work a beating*”.

The proceeding is completed to v. 9a,³¹ where it is explained that “*gāndhāra and niṣāda [are obtained with the movement of] the finger that opens a half [of the respective holes]*”.

Similarly (*cāpi*), are obtained the alterations, and that is *sād-hāraṇa* and *antara gāndhāra*, besides *kākalī niṣāda*.³²

The text is not particularly enlightening, above all because, if with the open holes are obtained three *svara* (*ṣaḍja, madhyama* and *pañcama*) and the other four are produced with the technique of the half a hole and of the beating, the number of the holes of the *vaṃśa* is not very clear.

It is not clear at all even the instrument’s intonation.³³ Because, in considering the double scale of basis, there could be two different instruments, tuned, respectively, on *ṣaḍja* and *madhyama*. Unless that – hypothesis already by me proposed in an another place and to which I send to³⁴ – the two *grāma* have the same tonic – Sa – and that they are differenced from one to another only in modal sense, thanks to the different number of *śruti* of *svara pañcama*. Any way, to try to make less hermetic the context, I believe it is determinant to go to the *Abhinavabhāratī* of Abhinavagupta,³⁵ that explains the use of the fingers

30. BhNŚGh, XXX, 8ab: “*vyaktamuktāṅgulikṛtā ṣaḍjamadhyamapañcamāḥ | dhaivatārṣabhaścaiva kampamānāṅgulikṛtau ||*”.

31. BhNŚGh, XXX, 9ab: “*ardhamuktāṅguliścaiva gāndhāro’tha niṣādavān | svarasādhāraṇe cāpi kākalyantarasaṃjñake ||*”.

32. See below, v. 9b.

33. Until the introduction of a diapason, it isn’t easy to imagine how could have been the intonation of a keynote, except with progressive adjustments between the voice and, even, a string of length and section well determined: that is to say a kind of diapason!

34. R. Perinu, “*L’esperienza descritto da Bharata, Nāṭyaśāstra, XXVIII, 24-28; e da Śārṅgadeva, Saṅgitaratnākara, I, 3, 10-22*”, in: *Bandhu, Scritti in onore di Carlo Della Casa*, II vols, Alessandria 1997, vol. I, pp. 301-317; for the general theory of the *grāma*, cfr. ID., *cit.*, pp. 25-30.

35. Abhinavagupta, *Abhinavabhāratī*, in BhNŚJ, vol. IV, 1984, p. 137; this quotation appears also in BhNŚGh, vol. II, transl. of chaps XXVIII-XXXVI, p. 51, n. 2 to the v. 7b-9a: “*ṣaḍjatvanāmikāṅgulyāvṛṣabho madhyamāṅgulau | niraṅgulyāñca gāndhāro madhyamaḥkampito yathā || vāmaste trayo’pyete catvāro dakṣiṇe punaḥ | pañcama nāmikāyām tu dhaivato madhyamāṅgulau || prādeśinyām niṣādastu madhyamaḥ kampito yathā ||*”.

like that: “*ṣaḍja on the ring finger, ṛṣabha on the middle, gāndhāra without finger (open hole), while madhyama [is obtained] with the beating; this three svāra [are made] on the left hand and the following four on the right: pañcama on the ring finger, dhaivata on the middle; on the forefinger niṣāda, while madhyama with the beating*”.

The distinction between the right and the left hand must lead to a consideration: unless the flutists of those times were left handed, and there is no reason to believe it, giving the undoubted sequence of the svāra in the text of Abhinavagupta – a flute, recorder or transverse that it might be, is usually held with the left hand near to the mouthpiece and with the right hand towards the end of the instrument. The right hand uses the thumb – and so does the left – to hold the tube and it takes the fore finger, the middle and the ring finger and not the little finger, that remains free. The left hand, the fore finger, the middle, the ring finger and the little finger: on the thumb rests the instrument that, differently, would remain without a support. Commonly, one uses eight fingers out of the ten of the two hands. Finally, in the western modern instruments, the left thumb works on a posterior hole – usually reinforced with a little ivory ring³⁶ – that, half opened with the movement of the phalanx, consents the passage to the notes of the high octave.

Now, considering the fingers indicated by the text and keeping in mind that the flute is tuned on its lowest *svāra*, which is obtained closing all the holes, it should be possible to understand, without doubt, how many holes there are in the described instrument.

Since the indicated fingers are five – three on the right hand and two on the left – one could think, first, that the holes are six; second, that, from the sequence of the holes opened one after another, the flute is tuned on *madhyama* and that, in the end, the adopted scale is probably the *madhyama grāma*. These observations find satisfying comfort in *Saṅgītaratnākara*, VI, 446a-447a,³⁷ in which the tuning of the flute con-

36. Cfr. above, p. 5. for what concerns the use of different materials of wood; instead, for the technique of the mouthpiece, cfr. C. Sachs, *The History of Musical Instruments*, it. transl. *Storia degli strumenti musicali*, Milano 1980, pp. 363-370 and 484-488. The text gives worth while information about the technique of playing the flute, both as recorder and transverse.

37. Cfr. ŚRSSub, *cit.*, vol. VI, 446a-450b: “*vyaktamuktāṅgulitvena samagro jāyate svāraḥ | aṅgulyāḥ kampāne tvatra śrutirekāpacīyate || 446 || śrutidvayaṃ tvar-*

tinues to be on *madhyama*, even if the holes are clearly seven and not six.

The text says: “*The svara is entirely born [of four śruti] thanks to the moving of the fingers [called] vyaktamukta; instead, with the beating is born [the difference of] only a śruti. [The svara of] two śruti [comes from the technique of the] ardhamukti, while [the svara] of three śruti with the beating [on the svara on which applies the technique of the half a hole]*”, as it is better explained by the Kallinātha’s³⁸ commentary.

In the *Saṅgītaratnākara*, VI, 448a³⁹ we find a very efficient image of the correct position of the two hands on the flute. They must assume a form “...as that of the hook of a snake”.

The text, after (vv.448b-450b), goes like that “*On the ring finger of the left hand [is done] ṣaḍja, while on the middle there is ṛṣabha; on the forefinger gāndhāra: so the left hand [where] three svara are born; four, instead, on the right; on the little finger there is madhyama, the svara pañcama on the ring finger*⁴⁰; *dhaivata on the middle, on the forefinger niṣāda.*”⁴¹

Taking again the text of the *Nāṭyaśāstra*, the vv. from 8a to 10b precise what has been confirmed in the v. 2b, relatively to the technique of sound production, and that is that “*ṣaḍja, madhyama and pañcama are obtained with the technique of vyaktamukta, dhaivata and ṛṣabha with the kampamāna; gāndhāra and niṣāda with the ardhamukta*”.⁴² To complete the picture of the *svara* of the *grāma* that

dhamukte tatkampe tu śrutitrayam | anyathā varṇayantiha kecit saptasvarodayam || 447 || arhdhendunāgaphanavad vaṁṣe sthāpyaṁ karadvayam | vāmasyanāmikāṅgulyā ṣaḍjo madhyamayā punāḥ || 448 || ṛṣabhaḥ syāt pradeśinyā gāndhāra iti vāmataḥ | trayāḥ svarāḥ prajāyante catvāro dakṣiṇāt karāt || 449 || kaniṣṭhaya madhyamaḥ syāt pañcamo'nāmaya svarāḥ | dhaivataḥ syānmadhyamayā pradeśinyā niṣādavan || 450 ||. (I quoted the text until the v. 450b for a question of completeness).

38. KSR, *cit. Comm.* to 446ab-447a: “*vyaktamuktāṅgulitvena...iti | śuddhāvasthoktaśrutiyukta ityarthaḥ | aṅgulyāḥ kampāne...iti | sa svarāḥ svopāntyaśrutim gacchatiyarthaḥ | śrutidvayaṁ tviti | ardhmukte śrutidvayamapacīyate | tatkampe tviti | ardhmuktāṅgulikampe tu śrutitrayamapacīyate iti sambandhaḥ || 446-447 ||*

39. ŚSR, *cit.*, VI, 448a: “*ardhendunāgaphanavad vaṁṣe sthāpyaṁ karadvayam |*”.

40. Worthy of note is the text of ŚSR, *cit.*, VI, 450a, which uses *anāmā* for ring finger, instead of *anāmikā*, as it appears clearly from the locative *anāmaya*.

41. Cfr. the above *cit.* text of ŚSR, VI, 448a-450ab.

42. BhNSGh, *cit.*, XXX, 8a-9a: “*vyaktamuktāṅgulikṛtṛṣaḍjamadhyamapañcamāḥ | dhaivataścārṣabhaścaiva kampamānāṅgulikṛtau || ardhmuktāṅguliścaiva gāndhāro 'tha niṣādavan ||*”.

one can obtain on the *vaṃśa*, the text takes in consideration the *svara* inflected (*sādhāraṇa*), *kākalī* and *antara* – referred respectively to *gāndhāra*, *niṣāda* and again to *gāndhāra*. The inflexions are referred to *niṣāda* – *kākalī* – as a diminution of *ṣaḍja*, and to *gāndhārasādhāraṇa* and *antara* – as double crescent inflexion of *svara madhyama*. It is, unfortunately, a simple systematic scruple, because, in reality, nothing is said on the way to obtain them: that is if with the technique of the half hole or with that of beating or better with fingers combination, to which the *Saṅgītaḍāmodara*⁴³ does clear mention, even if much later.

Let's examine, now, a particular kind of *vaṃśa*, described in *Rasakaumudī*, IV, 183b – 187b,⁴⁴ instrument that “*the flutists call pañcāṅgula*” (v. 187b).⁴⁵

The text is enough precise describing the instrument itself, starting from the mouthpiece. Meanwhile, is indicated the diameter of the tube, saying that “*it must be of the measure of the little finger*”. (v.183b)⁴⁶

The text continues giving other five precise indications. Like that: first, the diameter that, starting from the top, seems to spread from two *āṅgula*, until three and four (v. 184a⁴⁷); second, the position of the mouthpiece, an *āṅgula* far from the top (v.184b⁴⁸), thing that must lead to think to a traverse flute; third, one indicates the existence of the lifting blow-hole – *tārasvararandhra* – defined *manohara*, “*that has a beautiful sound effect*” (v. 185a⁴⁹); fourth, that “*to a progressive distance of half an āṅgula there are found other*

43. BhNŚGh, *cit.*, XXX, 9b-10b: “*svarasādhāraṇe cāpi kāklyantarasaṃjñake || niṣādagāndhārayoṣca ṣaḍjamadhyamayorapi* !”. For what concerns the sound production, cfr. C. Sachs, *cit.*, pp. 484-485, where it is explained clearly the difficulty linked to the changing of the melody, because of the complexity of fingers combination.

44. For what concerns the sound production, cfr. C. Sachs, *cit.*, pp. 484-485, where it is explained clearly the difficulty linked to the changing of the melody, because of the complexity of fingers combination.

45. ID, *ibid.*, 187b: see preceding note.

46. ID, *ibid.*, 183b: “*kaniṣṭhāṅgulimānena ...*”.

47. ID, *ibid.*, 184a: “*tasya dve trīṇi catvāriśrodeṣe 'ṅgulāni tu*”.

48. ID, *ibid.*, 184b: “*tyaktvā phūtkārasuṣīraṃ kāryamaṅgulimānataḥ*”.

49. ID, *ibid.*, 185a: “*mukharandhrād bhavettārasvararandhraiṃ manoharam*”.

seven holes” (186a⁵⁰); fifth, that the eight holes (seven plus mouth-piece) have the diameter and the shape of *badarī*’s seeds. (v. 186b).⁵¹

At this stage of my exposition, I think it is correct to examine a series of very precise prescriptions, concerning qualities and faults either of the execution or of the executor.

Meanwhile, *Nāṭyaśāstra*, XXX, 12,⁵² denounces a series of characteristics of the sound of the instrument, which, in this particular context, is the *veṇu*.

One says that “*all that is executed on the veṇu [has] firm [tuning], connected to varṇa and alaṃkāra, starts from the low keynote, follows [precise] rules, [and is] melodious*”.

The text, v. 13a,⁵³ concludes making reference to the *vaṃśayoktr*, to whom are directed the aforesaid operative indications: first of all, is the maker, the craftsman who has to have clear the musical result that the flutist should be able to obtain from the instrument that the first has known how to realize – obviously following all those details of choose of materials and so on, previously here explained.

After, the *Saṅgītadāmodara*, IV, 66ab,⁵⁴ which lists the five *guṇa* of sound emission (*phutkrta*): *fulness, surety, deepness, quickness, softness*. Follow, to the v. 67ab,⁵⁵ the six *doṣa*: “*to much use of the syllable śīt, stiffness, excessive marking of the svara, to much blown sound, harshness of timbre*”.

Either the qualities or the faults, taken together, represent a concise, but efficient summary for anyone who tries to play music not only with a flute but also with any blow instrument.

50. ID., *ibid.*, 186a: “*ardhāṅgulāntarāṇi syū randrāṅyanyāni sapta ca*”.

51. ID., *ibid.*, 186b: “*tānyaṣṭau badarībījasankāśāni bhavanti hi*”; for the *badarī* seeds, cfr. M.V. Macrì, *Lexicon cit.*, p. 102, where the identifications suggested are: *Ziziphus Jujuba Lamk*; *Carpogon pruriens Roxb*; *Goossypium Linn*.

52. BhŃŚGh, *cit.*, XXX, 12ab: “*avicalitamavikruṣṭam varṇālaṅkāra-saṃyutam mandram | vidhivallalitam madhuraṃ veṇorevaṃ smṛtam vādyam ||*”.

53. BhŃŚGh, *cit.*, XXX, 13a: “*evametatsvarakṛtam vijñeyaḥ vaṃśa-yoktrbhiḥ ||*”.

54. ŚSD, *cit.*, IV, 66ab: “*naividyam prauḍhatā cāpi susvaratvaṅca śighratā | mādhuryamiti pañcāmī phutkrteṣu guṇāḥ smṛtāḥ ||*”. The term *naividya* is in M-W., *cit.*, p. 570, col. 1, but under the reading “*nai-biḍya*”; this same term doesn’t appear in other cited Dictionaries: I suppose that *naividya* could be a wrong reading, since the very little graphic difference between the signs of the *va* and *ba*.

55. ID., *ibid.*, 67ab: “*śītkārabahulaḥ stabdho visvaraḥ sphuṭito laghuḥ | amadhuraśca vijñeyāḥ ṣaddoṣāḥ phutkrte kramāt ||*”.

In the same way, the fault goes to the flutist (*nindita*) who uses “to much head movements, who is not able to hold the right tuning, who uses to much repetition or makes little use of *svara*” (v. 68abc⁵⁶) in what is defined *gītavādana*, that is in the exposition or better in the interpretation of a musical piece.

The v. 69ab⁵⁷ follows listing the characteristics of the expert (*rakta*) flutist, he who knows very well his art: “he must be an expert of various types of register and times, richly endowed with the ornaments, [must] know how to pronounce clearly the syllables [useful to the sound production]; his hand must be very quick, must know the suitable times to the execution”.

The v. 70a⁵⁸ lists the indispensable qualities of the movement of the fingers, that are *prayukti*, *ardhayukti* and *yukti*, that is to say the use of combinations of the fingers, indispensable in order to obtain the various *svara*. The process of sound production with the fingers is completed to the v. 70b,⁵⁹ where “the correct position in the register and the melodiousness of the *svara*” are the perfect result of a high technical and interpretative quality.

Exactly this last characteristic is determined by vv. from 71a to 72b,⁶⁰ in which the expert flutist is individuated by “the expertise of the all ornaments, by the good handling of the families of the primary and secondary *rāga*, as well as from ability in the field of derived *rāga*’s forms: *kriyā*, *bhāṣā* and *vibhāṣā*. Besides, either in the correct or in the incorrect tuning [of the singers], the mastery of sound production [allows to] cover the [eventual] mistakes of the singers in keeping the correct register”.

56. ID., *ibid.*, 68ab: “*bahukṛtvaḥ śīraḥkampaḥ svasthānāprāptireva ca | vṛthāprayogabāhulyamalpatā gītavādane | ebhirdoṣairyuto’īva nindito vāmśiko mataḥ ||*”.

57. ID., *ibid.*, 69ab: “*sthānakādīlayābhijño gamakādhyah sphuṭākṣarah | śighra-hastah kalābhijño vaṃśiko rakta ucyaṭe ||*”.

58. ID., *ibid.*, 70a: “*prayuktirardhayuktiśca yuktiścetyaṅgulerguṇāḥ |*”.

59. ID., *ibid.*, 70b: “*svasthānatvaṃ susvaratvamaṅgulisāraṇakriyā ||*”.

60. ID., *ibid.*, 71a-72b: “*samastagamakajñāṃ rāgarāgāṅgaveditā | kriyābhaṣāvibhāṣāsu dakṣatā gītavādane || 71 || svasthāne cāpi duḥsthāne nādanirmāṇakauśalam | gātrnām sthānadāṛtvaṃ taddoṣācchādanantathā | vāmśikasya guṇā ete mayā saṃkṣipyā darśitāḥ || 72 ||*”.

IV. Conclusions

The general outline exposed here, considering that it presents rules contained in a series of treatises that cover about fifteen centuries, coming near to our era, even considering its inevitable obscurities, given to the fact that the users of the musical texts didn't need, as it happens to us, of particular precise statements, contained in the current knowledge of the musical practice, presents a situation of high technical and artistic level.

Technical level, as it clearly appears from the precise technological knowledge concerning materials and constructive devices; artistic, as it can be seen, without any doubt, from the subtle rules, but necessary to any musical practice, taught, as a *decalogue* of correct artistic behaviour, either to the musicians or to the simply music lovers, to put them on the right position to value the execution of these or that instrumentalist.

Finally, the rules here exposed, show, if still are needed, that Indian musical treatises are founded on a millenary tradition which effects are still evident in the actual practice, reconfirming an uninterrupted continuity – nearly transcendental – to the inevitable evolution of tastes and types, evolution without which the Indian music would be confined in the realm of the archaeological relicts, useful only from a historical point of view, but nothing else.

Still a consideration. I am convinced that the examination of the textual parts relative to the instruments is an investigating way along which the labour of the researchers will find wide satisfaction. Mine wants to be an invitation and at the same time a wish.

V. Lexicon

[Here are listed all technical terms contained in the text, save the musicological treatises and their authors]

alaṃkāra, sm, ornamentation

antara gāndhāra, sm, inflected kind of the *gāndhāra svara*

ardhamukta, sm, technique of sound production done by half opening a hole on the flute

ardhayukti, sf, kind of finger's combination in playing the flute

badari, sf, the seed of a particular plant (see note 52 below) the form of which is requested in piercing the cane of the flute

bhāṣā, sf, a kind of secondary *rāga*

carmavaṁśa, sm, a kind of wind instrument marked out by a skin bag

chidravādya, mfn, “furnished by holes”, a flute

ṛṣabha, sm, the second *svara* of the Indian scale

cukkā, sf, a kind of flute

dhaivata, sm, the sixth *svara* of the Indian scale

doṣa, sm, fault in musical execution

gītavādana, sn, musical execution, both vocal and instrumental

gāndhāra, sm, the tirdh note of the Indian scale

grāma, sm, the Indian musical scale

guṇa, sm, quality of the musical executor

kāhalā, sf, a kind of wind instrument

kākali niṣāda, sm, inflected kind of the *niṣāda svara*

kampamāna, mfn, technique of sound production done by swinging a finger near the hole of a flute

kampana, *idem*

kampita, *idem*

kāpalikā, sf, a kind of wind instrument

khadira, sm, a kind of suitable wood for wind instruments

kriyā, sf, form of secondary *rāga*

madhukarī, sf, a kind of wind instrument

madhuri, sf, a kind of wind instrument

madhyama, sm, the fourth *svara* of the Indian scale

madhyama grāma, sm, the second scale of musical Indian theory

murali, sf, kind of flute

naividya, sn, one of the five qualities (*guṇa*) of the sound emission

nindita, mfn, a bad flute player

- niṣāda**, sm, the seventh *svara* of the Indian scale
- pañcāṅgula**, sm, a kind of flute
- pañcama**, sm, the fifth *svara* of the Indian scale
- pāri**, sf, a kind of wind instrument
- pāvā**, sf, a kind of wind instrument
- pavikā**, sf, a kind of wind instrument
- phutkr̥ta**, sn, the sound production on a wind instrument
- prayukti**, sf, fingers combination in flute playing
- rāga**, sm, the melodic pattern of Indian musical theory
- raṅgaja**, sn, vermillion
- rakta [vaṁśika]**, sm, the perfect flute player
- raktacandana**, sm, a kind of suitable wood for wind instruments
- sādhāraṇa gāndhāra**, sm, inflected kind of *gāndhāra svara*
- sarala**, mfn, straight, avoiding quality of woods for wind instruments
- suṣira**, sn, the class of wind instruments
- svara**, sm, the note of the Indian scale
- śaṅkha**, sm, a conch shell, kind of wind instrument
- śṛṅga**, sm, horn, kind of wind instrument
- śilpavidyāpravīṇa**, mfn, “*clever in art and technique of wind instruments construction*”
- śiṁśapā**, sf, a kind of suitable wood for wind instruments
- ślakṣṇa**, mfn, avoiding quality of woods for wind instruments
- śodhita**, mfn, refined, said of good wind instrument
- śrikhaṇḍa**, sm, a kind of suitable wood for wind instruments
- śruti**, sf, the microtone or microinterval of Indian musical theory
- svaranābhi**, sm, a kind of wind instrument
- tārasvararandhra**, sn, the lifting blow-hole in a flute
- tittiri**, sf, a kind of wind instrument
- toḍahi**, sf, a kind of wind instrument
- tuṇḍukinī**, sf, a kind of wind instrument
- tvaksāra**, sm, a kind of suitable wood for wind instruments
- ṣaḍja**, sm, the first *svara* of the Indian scale

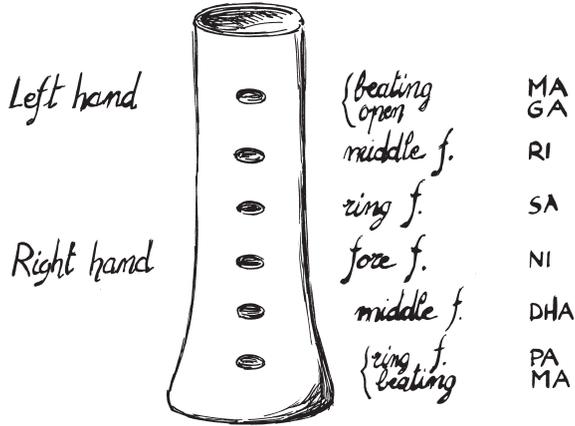
- ṣaḍja grāma**, sm, the first scale of the Indian musical theory
vainava, mfn, belonging to a flute; sm, the flute itself
varṇa, sm, musical sound
vaṃśa, sm, the flute
vaṃśayoktr, sm, the flute maker
veṇu, sm, a kind of flute
vibhāṣā, sf, a kind of secondary *rāga*
vinirmīta, mfn, constructed, said of a good wind instrument
vyaktamukta, sm, kind of sound production done by total opening of a flute hole
yukti, sf, fingers combination in flute playing

ABBREVIATIONS LIST

- AK, *Amarakośa*
 AGBh, *Abhinavabharatī* by Abhinavagupta
 KSR, commentary to *Saṅgītaratnākara* by Kallinātha
 SSR, commentary to *Saṅgītaratnākara* by Siṃhabhūpāla
 NPsS, *Pañcamasārasaṃhitā* by Nārada
 BhNō, *Nāṭyaśāstra* by Bharata: BhNŚGh, Ghosh edition
 a. BhNŚGhTxt, sanskrit text ed. by Ghosh
 b. BhNŚGhTr, translation by Ghosh
 c. BhNŚJ, Joshi edition
 d. BhNŚBs, translation by a Board of Scholars
 ŚRK, *Rasakaumudī* by Śrikanṭha
 ŚSD, *Saṅgītaḍamodara* by Śubhaṅkara
 ŚSR, *Saṅgītaratnākara* by Śārṅgadeva
 ŚSRSub, Subrahmanya edition
 ŚSRK, Kunhan Raja edition
 ŚSRPLSh, Prem Lata Sharma and Shringy translation
 AP, *Sanskrit-English Dictionary* by APTE, Vaman Shivram
 B, *Sanskrit-English Dictionary* by BENFEY, Theodore
 M-W, *Sanskrit-English Dictionary* by Monier-Williams, Monier
 R, *Dictionnaire Sanskrit-Français* by Stchoupak, N., Nitti, L., Renou, L.

Plan of the flutes described in:

I) Bharata, *Nāṭyaśāstra*, XXX, 1-13.



II) Śarṅgadeva, *Samgītaratnākara*, VI, 446-450.

