

śikṣā śāstra and Experimental phonetics

By vedavāridhi P. Rāmānujan,
C-DAC, 2/1, Brunton Road, Bangalore - 560 025.

‘नमो वाचे याचोदिता याचानुदिता तस्यै वाचे नमो नमो वाचे नमो वाचस्पतये नमः ऋषिभ्यो मन्त्रकृद्भ्यो मन्त्रपतिभ्यः’ (तै. आ. ७.१.१)

Introduction

In this paper, an attempt is made to describe the phonetic aspects of Sanskrit language, especially Vedic Sanskrit, for purposes of appreciating their significance and exploring ways of representing and using them for speech analysis/recognition in Computational platforms like multi-media based linguistic systems.

The Ancient Indian Science of Phonetics (śikṣā) is first of the six auxiliary branches of study (vedāṅga - śikṣā is likened to the nose of vedas) for the proper interpretation and understanding of vedas. The other vedāṅgas are : **chandas** (Metrics) - feet, **kalpa** (ritual Directory) - hands, **jyautiṣa** (astronomy) - eyes, **nirukta** (Etymology) - ears and **vyākaraṇa** (Grammar) - mouth (pā.śi. 41-42).

Many sages like *pāṇini*, *vyāsa*, *bhāradvāja*, *yājñavalkya*, *nārada*, *āpiśali*, *pāri* etc. have described Phonetics, and as such, different śikṣā works are attributed to them. Some of these are common for all vedas while some are specific to certain veda/sākhā. Here, we shall concern with *pāṇiniya śikṣā* for further discussions. This work is in the form of sixty verses and references to them here would be by their verse numbers. According to *pāṇini*, the purpose of the Science is to clarify the proper pronunciation of utterances (vācaḥ uccāraṇavidhi vyaktikaraṇam - pā. śi. 2).

Contents of śikṣā śāstra

As per *taittirīyāranyaka*, śikṣā deals with the pronunciation of the character set of Sanskrit language at varṇa, svara, mātṛā, balā, sāma and santāna levels. शीक्षां व्याख्यास्यामः । वर्णः स्वरः । मात्रा बलम् । सामं सन्तानम् । इत्युक्तः शीक्षाध्यायः ॥ (तै. आ. ५.२.१). What these signify is further discussed.

varṇaḥ : literals (vowels, consonants etc.) beginning with a. These total 63 or 64 (pā.śi. 3) twenty-one *svāras* (Vowels), twenty-five *sparśas* (stops), eight beginning with *ya* (four semi-vowels and four fricatives), four *yamas* (doubled characters under specified circumstances - explained in *prātiśākhya*s), *anusvāra*, *visarga*, *jihvāmūliya*, *upadhmāniya*, *ḷakāra* and *ḷkāra pluta* (pā.śi. 4-5).

svaraḥ : accent or intonation of three basic types, viz., *udātta* (acute), *anudātta* (grave) and *svarita* (circumflex).

mātṛā : duration of utterance - *hrasva* (short), *dīrgha* (long) and *pluta* (prolonged) for vowels.

balam : covers places of origin (eight) of sound and effort of articulation (internal and external).

sāma : balanced way of pronunciation (pā.śi. 31) having acceptable qualities (pā.śi. 33, 36-37) and without defects (pā.śi. 32, 34-35).

santānaḥ : Euphonic combinations (including their absence at specified situations).

The process of sound production

After a living 'being' (ātman) comes into contact with things through intellect, it stimulates the mind with the desire to express (its experiences). The mind triggers the body-fire which directs the inner air column. The air moving in the cardiac region produces a type of sound called 'mandra' in the mornings having *gāyatrī* as the metre, in the thoracic region in the afternoon produces 'madhyama' type of sound having *triṣṭup* as the metre and in the cerebral region in the evenings produces 'tāra' type of sound having *jagatī* as the metre. This uprising air column reaches the mouth after hitting the head region and produces all the varṇas (characters of literals) which are classified in five ways. (pā.śi. 6-9).

Parameters of varṇas

svara (accent), **kāla** (time), **sthāna** (place of utterance), **prayatna** (effort) and **anupradāna** (external effort) are the five factors that characterise varṇas. I

svaras (accents) are three as udātta (acute), anudātta (grave) and svarita (circumflex). The musical nature of these tones is referred to by attributing specific notes in the fundamental scale of music as : udātta - niṣāda (seventh) and gāndhāra (third), anudātta - ṛṣabha (second) and dhaivata (sixth) and svarita - ṣaḍja (first), madhyama (fourth) and pañcama (fifth). II

kāla (time) is hrasva (short), dīrgha (long) or pluta (prolonged) for vowels.

sthānas are eight - uraḥ (chest), kaṇṭhaḥ (throat), śiraḥ (head), jihvāmūlaḥ (root of the tongue), dantāḥ (teeth), nāsikā (nose), oṣṭhau (lips) and tālū (palate) (pā.śi. 10-13). I

I prayatna (ābhyantara - internal effort) is of four types as sprṣṭa, īṣatsprṣṭa, vivṛta and saṃvṛta (pā.śi. 38). III I III I II

anupradāna (the external effort - bāhyaprayatna) is of eleven types as vivāraḥ, saṃvāraḥ, śvāsaḥ, nādaḥ, ghoṣaḥ, aghoṣaḥ, alpaprāṇaḥ, mahāprāṇaḥ, udāttaḥ, anudāttaḥ and svaritaḥ. I I

I I I I Word Accents - Hand Indication I I

The accents have places of indication on the right hand. udātta is indicated by the index finger placed on the root of the forefinger. Ring finger is used for indicating svarita and middle finger for pracaya. anudātta is indicated on the little finger (pā.śi. 43-44). *yājñavalkya śikṣā* gives a very detailed account of hastacālanavidhi for śuklayajurveda. It is insisted that Vedic recitation without hand indication for accents is detrimental to the utterer (pā. śi. 54), while with it the reciter attains supreme bliss (pā. śi. 55). The correlation between accents, their attendant physiological effects, particularly at brain, tongue and finger-tips etc. is the subject of study in neurolinguistics.

I Accented word-types

There are nine types of accented words as (ending in udātta) antodātta, (beginning with udātta) ādyudātta, anudātta, nīcasvarita (svarita preceded by anudātta), madhyodātta (middle udātta), svarita, words with two udāttas and three udāttas (pā.śi. 45). Their examples are: अग्रिः, सोमः, प्र, वः, वीर्यम्, हविषाम्, स्वः, बृहस्पतिः, इन्द्राबृहस्पती respectively. (pā. śi. 46-47). Places of accents are hṛdaya (heart) for anudātta, mūrdhā (head) for udātta, kaṇāmūla (root of the ear) for svarita and sarvāsya (entire mouth) for pracaya (pā.śi. 48). I

The standard for the svaras (tones) are the sounds produced by : ṣaḍja - mayūra (peacock), ṛṣabha - gau (cattle), gāndhāra - ajāvika (goat and sheep), madhyama - krauñca (curlew), pañcama - pīka (cuckoo), dhaivata - vājī (horse) and niṣāda - gaja (elephant). The standard measure of kāla is mātrā (mora) which is specified for one, two, three and half mātrās (corresponding to vowels (short, long,

proluted) and consonants) is respectively that of the sounds produced by cāṣa (blue jay), vāyasa (crow), śikhī (peacock) and nakula (mongoose) (pā.śi. 49).

Method of Pronunciation

The instruction for uttering Vedic characters is like a tigress applying just the right amount of pressure while carrying its cubs by mouth; neither to hurt by teeth nor let them fall (pā. śi. 25).

yājñavalkya is more specific for certain types of characters, e.g.,
 The consonant *ha* when originating from chest (aurasya) is to be pronounced like the sound of clouds, kettle drum (dundubhi), water springing from a deep pond or the roar of a lion, like the sound of clouds in the month of bhādrapada or the sound reaching a cave, illustrated by शुक्रं दुदुहे (शु. य. सं. ३.१६) *śukraṁ duḍuhrē*.

For the guttural hakāra, he specifies the sound of monkeys climbing down and up in tree branches, illustrated in the hymn इहेहैषां (शु. य. सं. १०.३२) *ihēhaiṣāṁ* to stress that there should be pause between anudātta, udātta and svarita accents.

Between similar conjuncts, a pause of one mora is specified analogous to a lustful cock's utterance, illustrated by कुकुटोऽसि (शु. य. सं. १.१६) *kukkuṭo'si*.

For ñakāra pronunciation, he illustrates with the word युञ्जानः (शु. य. सं. ११.१) *yuñjānaḥ* that it should be like a mother kissing her son.

For nakāra pronunciation, he illustrates with the word सदुन्दुभे (शु. य. सं.) *sadundubhē* that it should be like a mare contracting and expanding her vulva on seeing a horse.

For makāra followed by pavarga, he cites the bellowing action of a frog's stomach region as the way of pronunciation, illustrating with the words अपां फेनेन (शु. य. सं. ११.७१) *apāṁ phēnēna*.

For pronouncing visarga, the instruction is like the puffing (exhaling) of men carrying heavy loads, illustrated by अद्भ्याः सम्भृतः (शु. य. सं.) *adbhyaḥ sambhṛtaḥ*.

For the Vedic anusvāra, the preceding vowel becomes heavy (guru) and is to be pronounced like the moans of a lustful woman illustrated by सिन्धसि (शु. य. सं. ५.१२) *siṁhyasi*.

Similarly, long vowels which are also heavy as illustrated in वार्ध्रिनसाः (शु. य. सं. २४.३९) *vārdhrīnasaḥ* and are to be pronounced like a vulture spreading his wings in air and contracting (yā. śi. uttarārdha, varṇoccārādhikāraḥ. 59-68).

Vedic accents - types

Vedic accents are pitch or musical accents in that they involve rise and fall of voice. The **udātta** (ut - uccaiḥ; ādīyate - uccāryate), which is the main accent in a word, means 'raised' and the rise is one of pitch or musical tone. This main accent also affects the pronunciation of the following syllable, as the restoration of voice to normal level is effected during its utterance. The accent of a syllable immediately following an *udātta* is termed *svārīta* which is described as a samāhāra or combination of raised and not raised (*anudātta*) voices. The main accent also affects the pronunciation of its preceding syllable, which is pronounced lower than normal and is termed *sannatara* by pāṇini. The other unaccented syllables are all *anudātta*s. Thus, out of the main accent of a word arise four different varieties of pitch, viz., *udātta*, *anudātta*, *svārīta* and *sannatara*.

Words defective with regard to literals or accents or wrongly applied do not denote their intended meanings. Such an utterance becomes *vajra* (deadly, lethal) and destroys the utterer as in the case of the word *indraśātru* (slayer of Indra) where, due to the mistake in the accent uttered, one who was supposed to have killed *indra*, got killed by him (pā.śi. 52).

Accental Semantics

A difference in accent accounts for a difference of meaning. As an illustration, the word 'yaśas' is neutral gender and means 'fame' when *ya* is acute, while the same word means 'famous' and becomes masculine when *śa* is acute. Examples are : युष्मिन् यशः (ऋ. सं. ८.१९.६); यशसं वीरवत्तमम् (ऋ. सं. १.१.३); त्वमिन्द्र यशा असि (ऋ. सं. ८.१०.५); etc. Similarly, the word 'brahman' is neutral and means sacred utterance, the supreme being, true knowledge or penance (Cf. amarakośa 3.3.114 - vedastattvaṁ tapo brahma, brahmā vipraḥ prajāpatiḥ) when *bra* is acute, while it is masculine and means priest when *ma* is acute. For example, ब्रह्म ब्रह्माऽभवत्स्वयम् (तै. का. ३.१.३).

Other examples of words identical in form but distinguished by accent could be :

1. ते - *they, those* (nom. pl. of the base तद्), as in ते ते पिबन्तु जिह्वया (ऋ. सं. १.१४.८) and ते - *to thee* (dat. sg. of the base युष्मद्), as illustrated in ये ते पन्याः सवितः पूर्वासः (ऋ. सं. १.३५.११);
2. दासः - *servant* | *slave* (substantive), as in स्वयं दास उरौ अंसावपि ग्ध (ऋ. सं. १.१५८.५), while दासः *servile* (adjective), illustrated in यो दासं वर्णमधरं गुहाकः (ऋ. सं. २.१२.४);
3. धर्मन् - neuter, meaning *ordinance, (solemnity, stay)* as in दिवो धर्मन् धरुणे सेदुषो नृन् (ऋ. सं. ५.१५.२) as against धर्मन् - masc. *ordainer, upholder*, as in धर्मा भुवद्गुण्यस्य राजा (ऋ. सं. ९.९७.२३);
4. दामन् - neuter, *cord, rope*, as in यद्वाजिनो दामं सन्दानमवतः (ऋ. सं. १.१६२.८) as against दामन् - masc. *bestower*, as in रायो दामा मतीनाम् (ऋ. सं. ६.४४.२);
5. द्वादश - *twelve*, illustrated by वेदं मासो धृतव्रतो द्वादश प्रजावतः (ऋ. सं. १.२५.८) as against द्वादश - *twelfth* as in देवहिंति जुगुप्सुर्द्वादशस्य (ऋ. सं. ७.१०३.९);
6. भूमन् - neuter, *earth*, as in चर्मवोदभिव्युन्दन्ति भूमं (ऋ. सं. १.८५.५) as against भूमन् - masc. *abundance* as in सौधन्वनासश्चितस्य भूमनाऽऽगच्छतः अपां भूमानमुषं नः सृजेह (ऋ. सं. १.११०.२, १०.९८.१२);
7. युवभ्याम् - *to you two* as in अरमिन्द्राग्नी मनसे युवभ्याम् (ऋ. सं. १.१०८.२) as against युवभ्याम् - *to the two youths*, from the stem *yuvan*, as in नमो युवभ्यो नम आशिनेभ्यः ; ससान मर्यो युवभिर्मखस्यन् (ऋ. सं. १.२७.१३, ३.३१.७);
8. रक्षः - neuter, *demonhood, (injury)*, as in इन्द्राग्नी रक्षं उब्जतम् (ऋ. सं. १.१२१.५) as against रक्षः - masc. *demon*, as in अपुसेधत्रक्षसो यातुधानान् ; यो वा रक्षाः शुचिरस्मीत्याह (ऋ. सं. १.३५.१०, ७.१०४.१६);
9. वरिमन् - neuter, *expanse* as in मितज्ञवो वरिमन्ना पृथिव्याः (ऋ. सं. ३.५९.३) as against वरिमन् - masc. *expanse*, as in दिवश्चिदस्य वरिमा वि पप्रथे (ऋ. सं. १.५५.१) etc.

Accents as word-category denoters

It is noteworthy here that words denote different class of objects when accented differently, i.e., accents have a link to the objects referred to by them. As a generalisation, we see words ending in udātta are substantives (Cf. phiṭ sūtra of śāntanava - phiṣonta¹udāttaḥ), while those with initial accent are adjectives, as these amount to an implied bahuvrīhi compound interpretation, i.e., 'one or that which

has (*word stem meaning*)'. This point deserves deeper consideration as it has a good potential in guiding speech recognition, in terms of supplying 'expected' categories of word and lexical category search. I

Compound words in Sanskrit have their meanings derived using the grammar rules wherein the constituent nominal stem meanings, suffix meanings and the compounding (or sambandha) meanings are involved. While a same surface form of a derived word could have two or more different processes of derivation with their different semantics, the determination of the appropriate meaning in a given context may be possible by considering the accents.

Illustrations of meaning change due to accent-change

To illustrate, the word '**indraśatruḥ**' which is a compound word, has two constituents, viz., *indra* and *śatruḥ*, where *śatru* means a killer. In the case of *bahuvrīhi* compounding इन्द्रशत्रुः, the first word retains its original accent and hence *i* is acute and the word would mean 'one whose killer is Indra'. Alternately, if the second word is accented, i.e., *tru* is acute इन्द्रशत्रुः (this compounding is called *tatpuruṣa*), it would mean 'Indra's killer'. A Vedic episode explains how a mistake committed in reciting this word in a sacrifice by **tvastā** resulted in a counter-productive consequence यदब्रवीत्स्वाहेन्द्रशत्रुर्वधुस्वेति तस्मादस्येन्द्रः शत्रुरभवत् (तै. सं. २.५.२.१).

I A similar example is quoted by sage patañjali in mahābhāṣya regarding the word '**sthūlapṛṣati**' appearing as an adjective of a sacrificial cow स्थूलपृषतीमाग्निवारुणीमनड्वाहीमालभेत, which when resolved as *tatpuruṣa* स्थूलपृषती (sthūlā ca sāl pṛṣadvatī ca), would have *ṣa* acute and mean 'big (fat) and spotted', while as a *bahuvrīhi* compound स्थूलपृषती (तै. सं. ५.६.१२) (sthūlāni pṛṣanti yasyāḥ sāl) - as opposed to क्षुद्रपृषती (तै. सं. ५.६.१२), *sthū* would be acute and mean 'one whose spots are big'. Obviously, one has to be precise in choosing the proper type of the cow (cow is big and *has* spots or *cow* with big spots).

Range of accent meanings

In general, pāṇini has referred to various aspects of speech like :

- vidhi* (optative),
- anujñaiṣaṇā* (seeking permission),
- āmantrāṇa* (giving free choice),
- nimantrāṇa* (invitation for a particular thing),
- prārthanā* (request), *āśiṣ* (benediction),
- atisarga* (seeking permission for a free choice),
- praiṣa* (order), I
- kāmapravēdana* (expressing one's purpose),
- adhiṣṭa* (polite),
- sambāvanā* (probability),
- anavakṣipti* (impossibility),
- kriyāprabandha* (continuity),
- kriyātipatti* (condition), II
- kriyāsamabhāra* (iterative),
- sāmuccaya* (simultaneity),
- sampraśha* (ascertaining by question),
- hētumat* (causative), I

hētuhēturnat (cause-effect),
prāptakāla (occasion), *icchā* (desire),
āśāṃsā (hope),
abhijñāvacana (recollection),
garhā and *bhāvagarhā* (derogatory and that affecting action only),
br̥ṣṭaprativacana (reply to a question),
pāṭīpsā (hurry),
amaṛṣa (bad feeling, ire),
citrikāraṇa (wonder),
prahāsa (ridicule) etc. while prescribing verbal tense/mood markers and describing sentence

accents etc. Thus, a same word to convey different aspect from among these is accented (stressed) variously and thus, the accents are helpful in determining the speaker's intentions. (Cf. *bhartṛhari* in *vākyapadīya* on word-meaning relation, .. *kālo vyaktiḥ svarādayaḥ* ...).

Experimental Indications

It is also seen in neuro-linguistic studies that the processing of natural language speech in the human brain is markedly different for noun and verb-forms and that ambiguous words with both these roles possible are processed in a peculiar fashion (e.g. a word like '*rock*'). Details of tongue, lip and even tip of the fingers experiencing electric wave flow while thinking and problem-solving, is brought forth by modern experiments. Even changing beliefs and habits by using neuro-linguistic programming has been shown to be effective. Thus, involuntarily, a perfect system for preserving Vedic texts free of any distortion, as also to ensure perfect physical and mental health (thoroughly uniform utilisation of all regions of brain and its activities as shown by Prof. Poppel's experiments) are achieved by the study of śikṣā śāstra⁴.

More examples/discussion

We could cite many examples of the same words being nouns and verbs in isolation, derived through different root-suffix combinations, determined on the basis of accents (e.g. तस्मान्नानादेवत्यानि सन्ति वायुर्वान्युच्यन्ते (तै. सं. ६.४.६.७); [*nānadēvatyāni*] *santi* - is a noun here;

' अङ्गिरसः सुवर्गं लोकं यतः पुरोडाशः कुर्मो भूत्वानुप्रासर्पत् (तै. सं. ५.२.८.४); *yataḥ* [*purōḍāśaḥ*] - *yataḥ* is a noun here [mas. acc. plural in śatṛ ending], only *yataḥ* derived from *yad* pronoun, as its suffix *taḥ* is *lit* - यतः - changes verb accents;

yathā - तं नेमिभूवो यथाऽऽनमस्व सहृतिभिः (तै. सं. २.६.११.१); आ सुवः संवितुर्यथा भगस्येव भुजिः हुवे (तै. सं. ३.१.११.८); when meaning similarity or analogy, *yathā* is unaccented - यथा - [as in these two cases] and does not accent verbs and only *yathā* derived from *yad* pronoun, as its suffix *thā* is *lit* - यथा - changes verb accents).

pāṇini has enumerated various circumstances for the change of default accents for nouns, verbs, particles, compounds, affixes etc. in aṣṭādhyāyī. Few examples are :

1. the word *viśvāhā* occurring at the beginning of the foot of a verse with four different accent patterns [with the first shown form meaning '*one who destroys all* (hostile)', while the other three forms having the same meaning as '*always, at all times*' or lit. '*on all days*'] -

- इन्द्रो नस्तत्र वृत्रहा विश्वाहा शर्म यच्छतु (तै. सं. ४.६.४.५); पदपाठे - विश्वाहेति विश्व - हा । इङ्ग्यं समस्तं पदम् ।
- ते गृहासो मधुश्चुतो विश्वाहाऽस्मै शरणास्सन्त्वत्र; and तिलवत्सा ऊर्मस्मै दुहाना विश्वाहाऽस्त्वनपस्फुरन्तीः (तै. आ. ४.७.१)। पदपाठे - (?) पदद्वयं यद्वा आरण्यकशिक्षया स्वरस्य साधुत्वम् ?

iii). तत्रा रथमुप शग्मः संदेम विश्वाहा वयः सुमनस्यमानाः (तै. सं. ४.६.६.३) । पदपाठे - विश्वाहेति विश्वा - अहा -

समस्तं इङ्गयं पदम् ।

iv). सिञ्चामहा अवटमुद्रिणं वयं विश्वाहाऽदस्तमक्षितम् (तै. सं. ४.२.५.५) । पदपाठे - विश्वा । अहा । इति व्यस्तं अनिङ्गयं पदद्वयम् ।

2. the word *indrāgni* (three accent patterns),

i). तास्सुष्टा इन्द्राग्नी अपागूहताम् (तै. सं. २.२.१.१); पदपाठे - इन्द्राग्नी इतीन्द्र - अग्नी ।

ii). उभा वामिन्द्राग्नी आहुवध्वै (तै. सं. १.१.१४.१); पदपाठे - इन्द्राग्नी इतीन्द्र - अग्नी ।

iii). इन्द्राग्नी आ गतम् (तै. सं. १.४.१५.१); - पदपाठे - इन्द्राग्नी इतीन्द्र - अग्नी ।

3. the word *dyāvāpṛthivī* (three accent patterns),

i). इदं द्यावापृथिवी भद्रमभूत् (तै. सं. २.६.९.५); - पदपाठे - द्यावापृथिवी इति द्यावा - पृथिवी ।

ii). अन्तस्ते दधामि द्यावापृथिवी अन्तरुर्वन्तरिक्षम् (तै. सं. १.४.३.१); पदपाठे - द्यावापृथिवी इति द्यावा - पृथिवी ।

iii). इन्द्राग्नी द्यावापृथिवी आप ओषधीः (तै. सं. १.२.१.२); - पदपाठे - द्यावापृथिवी इति द्यावा - पृथिवी ।

4. and *vājayaṭah* (accent change causing it to be a single word or a compound word)

i). अश्याम् वाजम्भि वाजयन्तोऽश्याम् द्युम् (तै. सं. १.३.१४.३); पदपाठे - वाजयन्तः । व्यस्तं पदम् (व्ययन्तम् ?)

ii). त्वया वाजं वाजयन्तो जयेम (तै. सं. १.४.४६.३); वाजयन्तो हवामहे (तै. ब्रा. २.४.६.४); पदपाठे - वाजयन्त इति वाज

■ ■ ■

- यन्तः । इङ्गयम् समस्तं पदम् ।

Verbal accents as sentence delimiters

The author's study of about 30000 verbal forms occurring in taittirīya saṃhitā have revealed many interesting aspects of word-meaning relations thru' accents. Verbal accents are dealt with in great detail in aṣṭādhyāyī and are quite significant in semantic extraction at sentence level. All words are unaccented except one syllable (anudāttaṃ padamekavarjam - aṣṭādhyāyī. 6.1.158) is the default rule. Then, verbs are all unaccented except at the beginning of a foot of a hymn (anudāttaṃ sarvamapādādau - aṣṭādhyāyī. 8.1.18) or when in association with the pronomial forms of yad (yadvṛttānityam - aṣṭādhyāyī. 8.1.66) or with certain particles designated nipāta etc (nipātairyadyadihanta ... - aṣṭādhyāyī. 8.1.30) or when followed by another verb (tiṇṇatiṇaḥ - aṣṭādhyāyī. 8.1.28). By default the verb is unaccented as in - पराऽस्य भ्रातृव्यो भवति (तै. सं. ३.४.६.२); - पदपाठे - भवति ।

A few sample illustrations of accented verbs are :

पादादौ - वेदाहमेतं पुरुषं महान्तम् (तै. आ. ३.७.७); असि युमो अस्यादित्यः (तै. सं. ४.६.७.१);

तिङ्तिङः - ता विष्णो पाहि पाहि यज्ञम् (तै. सं. १.१.११.२) (प्रथमं - पाहि ; द्वितीयं - पाहि) ; सर्वं प्राप्मानं तरति तरति

ब्रह्महत्यां (तै. सं. ५.३.१२.१-२); स्वेन भागधेयेनोपधावति धावति वाजम् (तै. सं. २.२.४.६); पिबन्तु मदन्तु वियन्तु सोमम् (तै. ब्रा.

२.६.११.१०); तस्माद्यज्ञोपवीत्येवाधीयीत याजयेद्यज्ञेन वा यज्ञस्य प्रसृत्यै (तै. आ. २.१.१) - तिङन्तत्रयं ; यस्माद्धीषाऽवेषिष्ठाः

पुलायिष्ठास्सुमज्ञास्थाः (तै. ब्रा. ३.७.८.२) - तिङन्तत्रयं एकमुपसृष्टं ; यत्सञ्चरत्युपविशत्युत्तिष्ठते च (तै. आ. ६.६.४.१); - उपसृष्टं

तिङन्तत्रयं ; आश्रावयास्तुश्रौषड्यजयेयजामहे वषट्कारः (तै. सं. १.६.११.२); - तिङन्तपञ्चकम् ? .

यद्वतात् - अग्ने यं यज्ञमध्वरं विश्वतः परिभूरसि (तै. सं. ४.१.११.१); यस्य समुद्रः रसया सहाऽऽहुः (तै. सं. ४.१.८.४-५)

। (पदकाले आहुः) ; अन्यत्र - ऋषय एनसाऽऽहुः (तै. सं. ३.२.८.१-२); - पदकाले आहुः ; प्राच्यां द्विशि त्वमिन्द्रासि राजतोदीच्यां

वृत्रहन्वृत्रहासि (तै. सं. २.४.१४.१); । पदपाठे - वृत्रहन्विति वृत्र - हुन् । वृत्रहेति वृत्र - हा । असि । Here, as accented and unaccented forms both give rise to the same surface (combined) form, the study of accent change is

necessary for proper vākyānta vēṣṭana during krama-pāṭha, i.e, वृत्रहा + असि = वृत्रहासि ; वृत्रहा + असि = वृत्रहासि ;

(निपातैर्यद्यदि ... ?); अव चोक्षति प्र च किरति शुद्धयै" (- उक्षति - तै. सं. ६.२.७.४); यदि बिभीयादुश्चर्मा भविष्यामीति (- बिभीयात् - तै. सं. २.२.१०.३);

| हि प्राप्स्या - आपो हि ह्य मयुधुर्वः (तै. सं. ४.१.५.१); देवा ह्येतमैन्धत (तै. सं. २.५.१.१). In long prose form of brāhmaṇa texts, sentence demarcation is easily done with the accent study. kalpasūtras and mīmāṃsāśāstra also deal with these considerably.

Specialities of Vedic Sanskrit

The accentual system as occurring in the Vedic texts and as described by pāṇini in aṣṭādhyāyī (vyākaraṇa) sometimes show differences and hence a set of works called prātiśākhya specific to individual Vedic branches are also needed to study accents. [These could be included under śikṣā vedāṅga]. Besides these, there are also many other lakṣaṇa-granthas which describe Vedic Phonetics. |

The various phonetic processes in the Vedas include, character set actually used in particular śākhās, exceptions to pragrhyas, doubling, elision, elongation, augments, modification, cerebralization, aspiration, euphonic combinations, distinction and unitization (anaikya and aikya), sub-types of the accents (anudatta as dīrgha, vikrama etc., svarita as nitya, kṣaipra, praśliṣṭa, prātihata, pādavṛtta, tairovyāñjana, abhinihata etc.), hand-signs for accents, kevala and miśra anusvāras of different kinds in different śākhās, kampa, raṅga-pluta, svarabhakti and its types and description of the various varṇa-krama parameters. |

varṇa-krama pāṭha (Vedic syllable characterisation)

As an excellent means of preserving the Vedic texts free of distortions in oral transmission, the ultimate step of describing every Vedic literal is practised which is known as varṇa-krama pāṭha. varṇa-krama is of five types as : śuddha varṇa-krama, svara varṇa-krama, mātrā varṇa-krama, aṅga varṇa-krama, and varṇasāra varṇa-krama. |

("kevalāḥ svarasaṃyuktaḥ mātrikāśahitastathā .
aṅgaṃ ca varṇasāraṃ ca pañca varṇakramāḥ smṛtāḥ ..").

In the last, we have the complete information of Vedic texts. This is brought out in the following verses :

"dhvaniḥ sthānaṃ ca karaṇaṃ prayatno devatā tataḥ .
jātirāṅgaṃ varṇasāñjñā vyāñjanānaṃ vidhīyate .." | [for consonants 8 parameters],
"acāmēvaṃ prōcyamānē dhvanyādāu ca yathākramam .
prayatnadēvayōrmadhyē mātrākālaḥ prakīrtitaḥ .." | [for vowels 8 parameters],
"udāttādi svarāṇāṃ tu dhvanyādīn pārivarjayet |
tathāpi devatājāti guṇarekhāvidarśanam ..
adhyetraṅgadyavasthāñca ṣaḍjādisvarakāraṇam .
svotpatti sthānakaṃ caiva śvāsañjñāñcānupūrvaśaḥ .." | [for accents 10 parameters],
"ye dharmāḥ śuddhavarṇe tu śāstroktā iha tānapi . |
saṃyojya tatra tatraiva bhakti raṅgādikān vadet ..
vyāñjanasyāṣṭadhā dharmāḥ svarasyaiva tathāṣṭadhā .
nīcōccādi svarāṇāṃ tu daśa dharmāḥ prakīrtitāḥ ..

vyāñjanōccādisaṃyukta svarasyaikaṣya vai punaḥ .
 śadvimśadadīrītādharmaḥ ka ityēṣa udāhṛtaḥ .. |
 imāṃ budhā varṇasāra bhūtaṣaṅkramamīdudh . "

[total per syllable 26 parameters],

These constitute the twenty-six parameters for each syllabic definition. Given below is the typical

||

Vedic character set with these details. |

... "नाद ध्वनि जनित नातिव्यस्त हनु स्थान तथाभूतोष्ठ करण संवृत प्रयत्न एक मात्रिक वायु देवताक ब्राह्मण जाति ह्रस्व संज्ञा सहित अकार",

"नाद ध्वनि जनित नातिव्यस्त हनु स्थान तथाभूतोष्ठ करण विवृत प्रयत्न द्वि मात्रिक वायु देवताक ब्राह्मण जाति दीर्घ संज्ञा सहित आकार",

"नाद ध्वनि जनित नातिव्यस्त हनु स्थान तथाभूतोष्ठ करण विवृत प्रयत्न त्रि मात्रिक वायु देवताक ब्राह्मण जाति विशिष्ट अवर्ण प्लुत",

"नाद ध्वनि जनित तालु स्थान नात्युपसंहतोष्ठ जिह्वामध्य करण विवृत प्रयत्न एक मात्रिक अग्नि देवताक ब्राह्मण जाति ह्रस्व संज्ञा सहित इकार",

"नाद ध्वनि जनित तालु स्थान नात्युपसंहतोष्ठ जिह्वामध्य करण विवृत प्रयत्न द्वि मात्रिक अग्नि देवताक ब्राह्मण जाति दीर्घ संज्ञा सहित ईकार",

"नाद ध्वनि जनित तालु स्थान नात्युपसंहतोष्ठ जिह्वामध्य करण विवृत प्रयत्न त्रि मात्रिक अग्नि देवताक ब्राह्मण जाति विशिष्ट इवर्ण प्लुत",

"नाद ध्वनि जनित दीर्घोन्नतोपसंहत उत्तरोष्ठ स्थान तथाभूत अधरोष्ठ करण विवृत प्रयत्न एक मात्रिक भूमि देवताक ब्राह्मण जाति ह्रस्व संज्ञा सहित उकार",

"नाद ध्वनि जनित दीर्घोन्नतोपसंहत उत्तरोष्ठ स्थान तथाभूताधरोष्ठ करण विवृत प्रयत्न द्वि मात्रिक भूमि देवताक ब्राह्मण जाति दीर्घ संज्ञा सहित ऊकार",

"नाद ध्वनि जनित दीर्घोन्नतोपसंहत उत्तरोष्ठ स्थान तथाभूत अधरोष्ठ करण विवृत प्रयत्न त्रि मात्रिक भूमि देवताक ब्राह्मण जाति विशिष्ट उवर्ण प्लुत",

"नाद ध्वनि जनित उत्तर दन्त मूलोपरि भाग स्थान नात्युपसंहतोष्ठ उपसंहततर हनु जिह्वाग्र करण विवृत प्रयत्न एक मात्रिक इन्दु देवताक ब्राह्मण जाति ह्रस्व संज्ञा सहित ऋकार",

"नाद ध्वनि जनित उत्तर दन्त मूलोपरि भाग स्थान नात्युपसंहतोष्ठ उपसंहततर हनु जिह्वाग्र करण विवृत प्रयत्न द्वि मात्रिक इन्दु देवताक ब्राह्मण जाति दीर्घ संज्ञा सहित ॠकार",

"नाद ध्वनि जनित उत्तर दन्त मूलासन्नोपरि भाग स्थान नात्युपसंहतोष्ठ उपसंहततर हनु जिह्वाग्र करण विवृत प्रयत्न एक मात्रिक अर्क देवताक ब्राह्मण जाति ह्रस्व संज्ञा सहित लृकार",

"नाद ध्वनि जनित तालूपसंहततर हनुमूलोपरि भाग स्थान ईषत्प्रकृष्टोष्ठ जिह्वामध्यपार्श्व करण विवृत प्रयत्न द्वि मात्रिक वायु देवताक ब्राह्मण जाति दीर्घ संज्ञा सहित अव्यञ्जन एकार",

"नाद ध्वनि जनित तालूपसंहततर हनुमूल स्थान ईषत्प्रकृष्टोष्ठ जिह्वामध्य करण विवृत प्रयत्न द्वि मात्रिक वायु देवताक ब्राह्मण जाति दीर्घ संज्ञा सहित सव्यञ्जन एकार",

"नाद ध्वनि जनित नात्युपसंहतहनु स्थान तथाभूतोष्ठ करण संवृत प्रयत्न अर्धमात्रिक आद्यंशभूत अकार, नाद ध्वनि जनित तालु स्थान नात्युपसंहतोष्ठ जिह्वामध्य करण विवृत प्रयत्न अर्धमात्रिक अन्त्यांशभूत इकार, उभयांश द्विमात्रिक अग्नि देवताक ब्राह्मण जाति दीर्घ संज्ञा सहित ऐकार",

"नाद ध्वनि जनित नातिव्यस्तहनु दीर्घोन्नतोपसंहततर उत्तरोष्ठ स्थान तथाभूताधरोष्ठ करण विवृत प्रयत्न द्वि मात्रिक भूमि देवताक ब्राह्मण जाति दीर्घ संज्ञा सहित ओकार",

"नाद ध्वनि जनित नात्युपसंहतहनु स्थान तथाभूतोष्ठ करण संवृत प्रयत्न अर्धमात्रिक आद्यंशभूत अकार, नाद ध्वनि जनित दीर्घोन्नतापासंहतोत्तरोष्ठ स्थान तथाभूताधरोष्ठ जिह्वामध्य करण विवृत प्रयत्न अर्धमात्रिक अन्त्यांशभूत उकार, उभयांश द्विमात्रिक इन्दु देवताक ब्राह्मण जाति दीर्घ संज्ञा सहित औकार",

"श्वास ध्वनि जनित हनुमूल स्थान जिह्वामूल करण स्पृष्ट प्रयत्न अर्ध मात्रिक पराङ्गभूत वायु देवताक ब्राह्मण जाति प्रथम सर्श संज्ञा सहित ककार",

"हकार ध्वनि जनित उत्तरोष्ठ स्थान अधरोष्ठ करण ईषत्स्पृष्ट प्रयत्न अर्ध मात्रिक पराङ्गभूत इन्दु देवताक क्षत्रिय जाति चतुर्थ सर्श संज्ञा सहित **भकार**",

"नाद ध्वनि जनित नासिका विवृति विशिष्ट उत्तरोष्ठ स्थान अधरोष्ठ करण स्पृष्ट प्रयत्न अर्ध मात्रिक पराङ्गभूत अर्क देवताक वैश्य जाति उत्तम सर्श संज्ञा सहित **मकार**",

"नाद ध्वनि जनित तालु स्थान जिह्वामध्यपार्श्व करण ईषत्स्पृष्ट प्रयत्न अर्ध मात्रिक पराङ्गभूत वायु देवताक वैश्य जाति (अन्तःस्थ संज्ञा सहित) विशिष्ट **यकार**",

"नादध्वनि जनित उत्तरदन्तमूलोपरिभाग स्थान जिह्वाग्रमध्य करण ईषत्स्पृष्ट प्रयत्न अर्ध मात्रिक पराङ्गभूत अग्नि देवताक वैश्य जाति (अन्तःस्थ संज्ञा सहित) विशिष्ट **रेफ**",

"नाद ध्वनि जनित उत्तरदन्तमूलासन्नोपरिभाग स्थान जिह्वाग्रमध्य करण ईषत्स्पृष्ट प्रयत्न अर्ध मात्रिक पराङ्गभूत भूमि देवताक वैश्य जाति (अन्तःस्थ संज्ञा सहित) विशिष्ट **लकार**",

"नाद ध्वनि जनित उत्तरदन्तान्त स्थान अधरोष्ठाभ्यन्तरान्त करण ईषत्स्पृष्ट प्रयत्न अर्ध मात्रिक पराङ्गभूत इन्दु देवताक वैश्य जाति (अन्तःस्थ संज्ञा सहित) विशिष्ट **वकार**",

"नाद ध्वनि जनित उत्तरदन्तान्त स्थान अधरोष्ठबाह्यान्त करण ईषत्स्पृष्ट प्रयत्न अर्ध मात्रिक पराङ्गभूत इन्दु देवताक वैश्य जाति (अन्तःस्थ संज्ञा सहित) विशिष्ट **ओष्ठ्य स्वरमध्यस्थ वकार**",

"अतिश्वास ध्वनि जनित तालु स्थान विवृत मध्यजिह्वामध्य करण विवृत प्रयत्न अर्ध मात्रिक पराङ्गभूत वायु देवताक शूद्र जाति (ऊष्म संज्ञा सहित) विशिष्ट **शकार**",

"अतिश्वास ध्वनि जनित मूर्ध स्थान विवृतमध्य प्रतिवेष्टितजिह्वाग्र करण विवृत प्रयत्न अर्ध मात्रिक पराङ्गभूत अग्नि देवताक शूद्र जाति (ऊष्म संज्ञा सहित) विशिष्ट **षकार**",

"अतिश्वास ध्वनि जनित उत्तर दन्तमूलाधोभाग स्थान विवृतमध्य जिह्वाग्र करण विवृत प्रयत्न अर्ध मात्रिक पराङ्गभूत भूमि देवताक शूद्र जाति (ऊष्म संज्ञा सहित) विशिष्ट **सकार**",

"हकार ध्वनि जनित कण्ठोरितनांश स्थान तदधोभाग करण विवृत प्रयत्न अर्ध मात्रिक पराङ्गभूत इन्दु देवताक शूद्र जाति (ऊष्म संज्ञा सहित) विशिष्ट **(कण्ठ्य) हकार**",

"हकार ध्वनि जनित उरारितनांश स्थान तदधोभाग करण विवृत प्रयत्न अर्ध मात्रिक पराङ्गभूत इन्दु देवताक शूद्र जाति (ऊष्म संज्ञा सहित) विशिष्ट **(उरस्य) हकार**",

"अतिश्वास ध्वनि जनित हनुमूल स्थान विवृतमध्य जिह्वामूल करण विवृत प्रयत्न अणु मात्रिक पूर्वाङ्गभूत अर्क देवताक शूद्र जाति (ऊष्म संज्ञा सहित) विशिष्ट **जिह्वामूलीय**",

"अतिश्वास ध्वनि जनित उत्तरोष्ठ स्थान विवृतमध्य अधरोष्ठ करण विवृत प्रयत्न अणु मात्रिक पूर्वाङ्गभूत अर्क देवताक शूद्र जाति (ऊष्म संज्ञा सहित) विशिष्ट **उपध्मानीय**",

"अतिश्वास ध्वनि जनित कण्ठोरितनांश स्थान तदधोभाग करण विवृत प्रयत्न अर्ध मात्रिक पूर्वाङ्गभूत अर्क देवताक शूद्र जाति विशिष्ट **विसर्जनीय**",

"नाद ध्वनि जनित नासिका विवृति विशिष्ट नासिकोपरिभाग स्थान तदधोभाग करण विवृत प्रयत्न एक मात्रिक पूर्वाङ्गभूत अर्क देवताक शूद्र जाति विशिष्ट **मिश्रानुस्वार**",

"नाद ध्वनि जनित विवृत नासिकोपरिभाग स्थान तदधोभाग करण गकाराद्यन्यधर्म विवर्जित विवृत प्रयत्न द्वि मात्रिक पूर्वाङ्गभूत अर्क देवताक शूद्र जाति विशिष्ट **केवलानुस्वार**",

"नाद ध्वनि जनित उत्तरदन्तमूलोपरिभाग स्थान नात्युपसंहतोष्ठोप संहततर हनुजिह्वाग्र करण विवृत प्रयत्न आद्यंशभूत अणुमात्रिक ऋकार, नाद ध्वनि जनित उत्तर दन्तमूलोपरि भाग स्थान जिह्वाग्र मध्य करण ईषत्स्पृष्ट प्रयत्न अन्त्यांशभूत अणुमात्रिक रेफ, उभयांश अर्ध मात्रिक संवृत करण विवृत प्रयत्न पूर्वाङ्गभूत अर्क देवताक शूद्र जाति करेणु संज्ञा विशिष्ट **हलन्ता स्वर भक्ति**",

"र/ल्", "नाद ध्वनि जनित उत्तरदन्तमूलोपरिभाग स्थान जिह्वाग्रमध्य करण ईषत्स्पृष्ट प्रयत्न आद्यंशभूत अणुमात्रिक रेफ, नाद ध्वनि जनित उत्तर दन्तमूलोपरि भाग स्थान नात्युपसंहतोष्ठ उपसंहततर हनु जिह्वाग्र करण विवृत प्रयत्न अन्त्यांशभूत अणुमात्रिक ऋकार, उभयांश अर्ध मात्रिक विवृत करण विवृत प्रयत्न पूर्वाङ्गभूत अर्क देवताक शूद्र जाति कर्षिण्यादि संज्ञा विशिष्ट **अजन्ता स्वर भक्ति**",

"नाद ध्वनि जनित नातिव्यस्तहनु स्थान तथाभूतोष्ठ करण विवृत प्रयत्न निरनुनासिक हृदय कमलोत्थित शार्दूल रुतोर्बुहित मन्द्र ध्वनि युत पूर्वाङ्गभूत द्विमात्रिक मूर्ध स्थान जनित कांस्य घण्टा नाद तुल्य कम्प विशिष्ट मध्यम भाग, द्वितीयांशभूत एकमात्रिक

नासिका बिलद्वय विनिस्सृत श्रुतिसुखाख्य अव्यक्त सूक्ष्मनाद सहित, तृतीयांश भूत एकमात्रिक सौराष्ट्रिक नारी स्वर सम आद्यन्त्यांशत्रय निरूपित चातुर्मात्रिक वायु देवताक ब्राह्मण जाति विशिष्ट **रङ्ग प्लुत**",

"भूमि देवताक ब्राह्मण जाति सात्विक गुण सहित तर्जिन्यङ्गुलिमध्य रेखान्यास योग्य अध्येतृदेह दैर्घ्य ध्वनि काठिन्य कण्ठाकाश कृशत्व जनित अजारुततुल्य गन्धार स्वर हेतुभूत मूर्धस्थानोद्भव **उदात्त** स्वर सहित",

"अग्नि देवताक क्षत्रिय जाति तामस गुण सहित कनिष्ठिकाङ्गुल्याद्य रेखान्यास योग्य अध्येतृदेह ह्रस्वत्व ध्वनि मार्दव कण्ठाकाश महत्त्व जनित वृषरुततुल्य वृषभ स्वर हेतुभूत हृदयस्थानोद्भव **अनुदात्त** स्वर सहित",

"अग्नि देवताक क्षत्रिय जाति तामस गुण सहित कनिष्ठिकाङ्गुल्याद्य रेखान्यास योग्य अध्येतृदेह ह्रस्वत्व ध्वनि मार्दव कण्ठाकाश महत्त्व जनित केकीकेकारुततुल्य षड्ज स्वर हेतुभूत हृदयस्थानोद्भव **दीर्घानुदात्त** स्वर सहित",

"अग्नि देवताक क्षत्रिय जाति तामस गुण सहित कनिष्ठिकाङ्गुल्याद्य रेखान्यास योग्य अध्येतृदेह ह्रस्वत्व ध्वनि मार्दव कण्ठाकाश महत्त्व जनित वृषरुततुल्य वृषभ स्वर हेतुभूत केकीकेकारुततुल्य षड्ज स्वर हेतुभूत हृदयस्थानोद्भव दृढतर प्रयत्न **विक्रमानुदात्त** स्वर सहित",

"इन्दु देवताक वैश्य जाति राजस गुण सहित अनामिकाङ्गुल्यन्त्य रेखान्यास योग्य अध्येतृदेह दैर्घ्य ह्रस्वत्व ध्वनि काठिन्य मार्दव कण्ठाकाश कृशत्व महत्त्व समाहार जनित गजबृंहिततुल्य निषाद स्वर हेतुभूत कर्णमूल स्थानोद्भव दृढतर प्रयत्न **नित्य स्वरित** स्वर सहित",

"इन्दु देवताक वैश्य जाति राजस गुण सहित अनामिकाङ्गुल्यन्त्य रेखा न्यास योग्य अध्येतृदेह दैर्घ्य ह्रस्वत्व ध्वनि काठिन्य मार्दव कण्ठाकाश कृशत्व महत्त्व समाहार जनित गजबृंहिततुल्य निषाद स्वर हेतुभूत कर्णमूल स्थानोद्भव दृढतर प्रयत्न **क्षीप्र स्वरित** स्वर सहित",

"इन्दु देवताक वैश्य जाति राजस गुण सहित अनामिकाङ्गुल्यन्त्य रेखा न्यास योग्य अध्येतृदेह दैर्घ्य ह्रस्वत्व ध्वनि काठिन्य मार्दव कण्ठाकाश कृशत्व महत्त्व समाहार जनित गजबृंहिततुल्य निषाद स्वर हेतुभूत कर्णमूल स्थानोद्भव दृढतर प्रयत्न **अभिनिहत स्वरित** स्वर सहित",

"इन्दु देवताक वैश्य जाति राजस गुण सहित अनामिकाङ्गुल्यन्त्य रेखा न्यास योग्य अध्येतृदेह दैर्घ्य ह्रस्वत्व ध्वनि काठिन्य मार्दव कण्ठाकाश कृशत्व महत्त्व समाहार जनित गजबृंहिततुल्य निषाद स्वर हेतुभूत कर्णमूल स्थानोद्भव मृदुतर प्रयत्न **प्रश्लिष्ट स्वरित** स्वर सहित",

"इन्दु देवताक वैश्य जाति राजस गुण सहित अनामिकाङ्गुल्यन्त्य रेखा न्यास योग्य अध्येतृदेह दैर्घ्य ह्रस्वत्व ध्वनि काठिन्य मार्दव कण्ठाकाश कृशत्व महत्त्व समाहार जनित गजबृंहिततुल्य निषाद स्वर हेतुभूत कर्णमूल स्थानोद्भव मृदुतर प्रयत्न **प्रातिहत स्वरित** स्वर सहित",

"इन्दु देवताक वैश्य जाति राजस गुण सहित अनामिकाङ्गुल्यन्त्य रेखा न्यास योग्य अध्येतृदेह दैर्घ्य ह्रस्वत्व ध्वनि काठिन्य मार्दव कण्ठाकाश कृशत्व महत्त्व समाहार जनित गजबृंहिततुल्य निषाद स्वर हेतुभूत कर्णमूल स्थानोद्भव अलतर प्रयत्न **तैरोव्यञ्जन स्वरित** स्वर सहित",

"इन्दु देवताक वैश्य जाति राजस गुण सहित अनामिकाङ्गुल्यन्त्य रेखा न्यास योग्य अध्येतृदेह दैर्घ्य ह्रस्वत्व ध्वनि काठिन्य मार्दव कण्ठाकाश कृशत्व महत्त्व समाहार जनित गजबृंहिततुल्य निषाद स्वर हेतुभूत कर्णमूल स्थानोद्भव अल्पतर प्रयत्न **पादवृत्त स्वरित** स्वर सहित",

"अर्क देवताक शूद्र जाति तामस गुण सहित मध्यमाङ्गुलि मध्य रेखा न्यास योग्य ईषन्न्यून अध्येतृदेह दैर्घ्य तथाभूत ध्वनि काठिन्य कण्ठाकाश कृशत्व जनित क्रौञ्च क्वणनतुल्य मध्यम स्वर हेतुभूत सर्वाङ्ग(स्य) स्थानोद्भव **प्रचय** स्वर सहित".

Conclusion

Thus, the various phonetic aspects dealt with in the ancient Indian śikṣā śāstras can be an invaluable source of ideas for an objective study of speech processes with the help of state-of-the-art techniques and equipments, so as to serve the purpose of developing utilitarian speech recognition systems for Indian languages. An objective set of evaluation criteria is to be developed to cover all the various śikṣā śāstra contents (especially sāmavedic śikṣās) and Vedic texts and their study and structural modelling etc. is to be undertaken. A phonetic database of Vedas is to be the starting point and a multi-disciplinary research involving Computer technologists, Vedic and śāstraic scholars and neuro-scientists etc. is to be initiated to get a proper understanding of the issues, their handling and Ancient Indian Phoneticians' and grammarians' contribution to Natural Language Processing and Understanding.

C-DAC has taken the lead in defining and developing Standards for representing Indian character sets on computer media through the GIST range of products (hardware and software) for various platforms. Annex - G of IS 13194 : 1991 on ISCII describes the Vedic accent-marker use through Computers. Recently, we have rendered the ṛgveda saṃhitā computationally. With many other texts in śikṣā, nirukta, nighaṇṭu, prāṭisākhya, sarvānukramaṇikā etc. available in machine-readable form, we wish to endeavour more in the area of accent-meaning analysis in the Vedic module of our deśika (DESIKA) software. nirukta, nighaṇṭu and such other etymological works are also being integrated into deśika to have Vedic Concordance in a computational form to facilitate such research. Necessary software utilities could also be developed. Efforts for getting the other Vedic texts in machine-readable form are also under way and with divine support, we hope to contribute to this field significantly. We now end with śrī vedāntadeśika's concluding prayer in mīmāṃsā pādukā :

śākyolūkyākṣapāda-kṣapaṇaka-kapilāmartyavandya-pradhānaiḥ
anyairāmnāyacarcākavacadhṛṭikanadgomukhadvipibhiḥca .
baṃhiyaḥ kṣobhitā'pi śrutirihā bahudhā jāyamānena goptrā
kālekāle'bhīguptā kalahamatitarantyakṣatā rakṣatānnaḥ ..

priyatām vedavedyo janārdanaḥ . śubhamastu ..

I References I

- (तै. सं. #.#.#.#) - तैत्तिरीय संहिता. काण्ड. प्रपाठक. अनुवाक. पञ्चाशत् संख्या
(तै. ब्रा. #.#.#.#) - तैत्तिरीय ब्राह्मणं. अष्टक. प्रपाठक. अनुवाक. दशति संख्या
(तै. आ. #.#.#.#) - तैत्तिरीय आरण्यकं. प्रपाठक. अनुवाक. दशति संख्या - द्राविडपाठानुसारेण
(तै. का. #.#.#.#) - तैत्तिरीय काठकं. प्रपाठक. अनुवाक. दशति संख्या
(ऋ. सं. #.#.#.#) - ऋग्वेद संहिता. मण्डल. सूक्त. 'मन्त्र संख्या
(शु. य. सं. #.#.#) - शुक्ल यजुः संहिता. प्रपाठक. मन्त्र संख्या
(pā. śi. #) - pāṇiniya śikṣā. ślokaśaṅkhyā.
(yā. śi. #) - yājñavalkya śikṣā. ślokaśaṅkhyā.

1. pāṇiniya śikṣā, in siddhānta kaumudī + tattvabodhinī, Chowkhamba, vārāṇasī, 1985.
2. yājñavalkya śikṣā, with śikṣāvallī comm., jyotiṣa prakāśa Press, vārāṇasī, 1962.
3. The Descriptive Technique of pāṇini - By Prof. V. N. Miśra, Mouton & Co., 1966.
4. Neurolinguistics, Computer and Sanskrit By P. K. Acharya, **Sanskrit and Computer**, (Proc. of IUGC National Seminar), Ed. by Dr. K. C. Dash, Pratibha Prakashan, 1995.

