

ANCIENT INDIAN CONCEPTION OF ACOUSTIC SPEECH SIGNAL AND ITS PERCEPTION

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The phonetic literature is cleverly presented in the *Shikshās* and the *Prātishākhya* treatises of India. For acoustic phonetics, Vākyapadiya of Bhartṛihari deserves special mention. There is a sort of misunderstanding regarding the scope of ancient Indian Shikshā literature. The fact is that here and there, some observations of amazingly wide scope occur in this literature, its actual scope is rather narrow but sure enough intensive. This has been pointed out by the *Ṛigveda Prātishākhya*, in the topic phonotactic behaviour of the end of a word when meeting the next word. Shikshā literature is an intensive survey of this phenomenon. A very important, though secondary, purpose of this literature was the teaching of pronunciation.

In this paper, ACOUSTIC has been taken in the sense of 'audition'; at the present time, however, acoustic has a different connotation. During the first half of the twentieth century, 'acoustic' had a wider significance, meaning anything pertaining to the ear; but during the second half, the ear has become secondary, yielding place to mechanical instruments used for the ear to perceive a sound. So far as Indian treatises are concerned, we take 'acoustic' in the sense of 'audition', and not in its modern prevalent sense. Realistically speaking it may be called the non-acoustic aspect of listening, for it does not pertain to the instruments, but is confined to the ear.

Every speech symbol is a representation, an ideational stage of something. As it pertains to a comparatively higher stage of human thought, it must succeed perception. We first perceive and then we may symbolise. A child perceives much earlier than he is able to symbolise. The reality of the varieties of single speech sound was pointed out by Kātyāyana; he also standardised the representative form — *Ākriti*, which somewhat approaches the modern 'phoneme'.

The important place occupied by perception in the process of learning and communication of speech is evident; in fact, the perception of speech sound is becoming one of the world's topmost subjects, as it is an essential element of the Information Theory. It is being realised more and more that we actually perceive a very little percentage of what we hear. In a brilliant observation Patanjali said 'irregular words are those the speech sound of which is heard by the ear, but not articulated' — *shrūyante na*

cocoyante. Patanjali was here referring to glides, being involuntary speech sounds, which the speaker thinks he never pronounced, but which are actually heard by the technician.

My main contention in this paper is that the process of production and reception of sounds is elaborately mentioned and analysed in ancient Indian works, namely those mentioned above. In *Vākya-padiya*, for example, the mechanism of production and reception has been accurately examined: both the processes are, in fact, the two aspects of one and the same thing, namely, expression. At the one end is the speaker, and at the other, the listener. *Ichā*, *Manobhāv*, *Prayatna* and *Dhwani* go to the speaker and *Nād*, *Sphoṭ*, *Dhawni* and *Swarūp* are related to the listener. They begin, respectively from *Atmā*, *Man*, *Prāṇ* and *Mukh* and are carried through in the reverse process. The ear is attributed with the quality of ether, in which sound is permanently present. It is effective through the organs of speech. This is the theory of *Sphoṭvād*. The sound shapes *sphoṭ* and the meaning is exposed. The ear receives that very phenomena to which it is related. This was observed by Patanjali as well. Explaining it further, Nāgēsh says that the last one of the sounds leads to the meaning. The earlier sounds create the proper atmosphere only, it is the last sound that fulfils the mission. Another Indian phonetician, Kāiyaṭ, says that though sound is present everywhere and at all times, it is perceived only when we make an attempt to pronounce it. Bhartṛihari puts it more scientifically.

Taking *sphoṭ* into consideration there are four things in speech perception: —

(1) Sound is not different from disclosure or *Sphoṭ*, both are audible simultaneously

(2) Sound is not expressed physically in itself but it leads to perception with the help of *sphoṭ*.

(3) Disclosure or *sphoṭ* is invisible; it is grasped through the medium of sound.

(4) *Sphoṭ* is ever present; it is made effective to the ear by means of the sound.

Thus this particular phenomenon plays an important part in the perception of sound and has been dealt with elaborately by Indian phoneticians.

The process of audition, among Indian thinkers, is often related to two disciplines, known as the *Kadamb Korak (golak) Nyāya* and the *Vici-Tarang Nyāya*. The *Kadamb Korak (golak) Nyāya* means that as the *Kadamb* tree gets buds, they burst forth over it simultaneously in the same way in which the word is a sum total of all the sounds taken collectively. The sound is spreading in all the ten directions, and when an attempt is made to pronounce the sounds, which are so spread out, they get together and produce an audible shape of the word. The other *Nyāya* describes the idea that as the small waves come out of the big one, one after the other, till they reach the end, in that same way the sound gets its shape from the pervading cosmos and moves forward till it reaches the object where it explodes and is perceived. This goes on perpetually. Both the theories establish the fact that as the buds blossom simultaneously over the *Kadamb*, or as the ripples make a constant move, so also does sound. However, there is one thing to note. In the first *Nyāya*, the process is simultaneous and the effect is the sum total of all the factors; in the second, the effect

is the outcome of a regular process which has an unending continuity. Thus the process of audition does not take place in seclusion.

According to the physical principles of mechanics and acoustics we learn that the sense of hearing, and organs thereof, are really subjects of physiological and psychological research, rather than only physical. This truth was realised by early Indian phoneticians; it is for this reason that in all their theories, the psychological aspect is upheld above all. The Indian phoneticians were also aware of the fact that sound is a permanent phenomenon and that it exists throughout everything. It was further established by them that the sound waves are generally slanting, the direct ones being too powerful; only a *yogin* could tolerate them, he being used to *Anahad Nād*.

In audition there is a certain relationship between the consonant and the vowel sounds. The theory that the consonant has no existence as a sound has been explored. The *Nārḍiya Shikshā* tells the same tale. It points out that consonants are like pearls in a necklace, but the thread that supports them is the vowel. These facts are based on practical audition, analysed by the god-given apparatus, the efficiency of which is still recognised. To take an example we find that the rules of the *Sandhis* are based on accurate acoustic observation. Indo-Aryan linguistics has inherited a firm basis of phonetic description. It does not spend much time in discussing the mental or the neural bases of speech. Their process was like this: the soul, apprehending things with the intellect inspires the mind with a desire to speak; the mind then excites the bodily fire which in its turn impels the breath. The breath circulating in the lungs is forced upwards, impinging upon the head reaches the speech-organs and gives rise to speech sounds.

In these short observations I have just hinted at the way followed by Indian scholars. *Shabda*, to the Indian phonetician, had a high place; it being the manifestation of the *Brahma*. It is well-known to the academic world that Pāṇini was the first precursor of speech symbology: the tradition continued for sometime, but the science did not continue; fortunately, the West picked up the threads, but the bewildering situation is that even now, the right symbologies for our languages are not being evolved. We are all struggling, considering it our duty, as the *Gītā* commands us—“work is our duty not the result”.

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DISCUSSION

SINGH (Washington)

This was an excellent presentation of some very important notions amongst the ancient Indian Phoneticians regarding the production and perception of speech signals. Some of these notions are now being proposed, in different manner however, as

theory by the Western scientists. For example, in Patanjali's concept of *Sruyante na cocyante* I see a clear hint of the motor theory of speech perception. My humble request to Professor Gupta is to elaborate some of these points in a larger article.

GUPTA

The learned author of this question wants me to elaborate the ideas contained in the paper. The suggestion is gratefully acknowledged.

BUSH (Stanford)

I agree with Professor Singh. We owe a great debt to the phoneticians of ancient India. Their expression of the relationship of consonants and vowels in the stream of speech is especially interesting ("the consonants are like pearls in a necklace but the thread that connects them is the vowel"). We find fault with the Western image of the sounds of speech as 'beads on a string'. This ancient Indian version is far more appropriate to what is known about the physiological and acoustical character of human speech.