

DISTINCTIVE FEATURE THEORY AND PANINIAN MAHESHWARA SUTRAS: A COMPARATIVE ANALYSIS

Aishwarya Vardhani Aarugonda, Research Scholar, EFL University

Hemanga Dutta, Assistant Lecturer, EFL University

a.aishwaryavardhani@gmail.com and hemangadutta1@gmail.com

Abstract

This paper tries to draw the parallels between Distinctive Features theory and Paninian Maheshwara Sutras which are distant in time and space. Distinctive features, popularised by Chomsky and Halle in 1968 with the publication of Sound Patterns of English, claims that phonemes are not the minimal distinctive unit in the sound system of a language as they can be decomposed into distinctive features constituting them. On the contrary, Paninian Shiva sutras which precede his Astadhyayi in the form of 14 sutras indirectly provide reference to phonetic specifications and articulatory details involved in the arrangement and organization of Sanskrit phonemes. The principle governing DF theory is binarism whereas the principle of phonetic similarity and pattern congruity can be considered as building blocks of Paninian Maheshwara Sutras. However, the way DF theory categorises the segments in terms of Major class features, Cavity features, Laryngeal features, Manner features etc based on phonetic parameters pertaining to place and manner can have some shared assumptions with that of Paninian Maheshwara Sutra which categorises vowels, glides, nasals, sibilants and stops in separate classes and therefore in separate sutras. Although it is not possible to have one to one correspondence between Paninian Sutras and Distinctive Feature theory the principle of economy and precision can be shown as the common property between the two approaches.

Key words: Maheshwara sutra, Distinctive Features, Binarism, Phonetic similarity

1.0 Introduction:

Panini is an Indian grammarian who wrote a treatise on the grammar of Sanskrit language, using a system of notation called Pratyaharas based on the arrangement of Sanskrit speech sounds in the form of 14 verses called the Maheshwara sutras. The Distinctive Feature theory is a phonological theory proposed by Roman Jakobson and popularised by Noam Chomsky

and Morris Halle in the 1968 with the publication of Sound Pattern of English (SPE), which talks about the minimal distinctive sound units in phonology. This paper analyses the arrangement of Maheshwara sutras in terms of the respective combinatorial elements and forms their natural classes. It is divided into five sections.

Section 1 talks about the development of Distinctive feature theory and its components while introducing the concept of Natural Class. Section 2 provides the background and uses of Maheshwara sutras. Sections 3 and 4 deals with the comparison of Maheshwara Sutras with Distinctive feature Theory and its analysis. The conclusions are summed up in section 5. This paper gives an introduction to Maheshwara Sutras and their prominence in Panini's grammatical description of Sanskrit language. It looks at the classification of Maheshwara Sutras and tries to see to what extent they reflect their Natural Classes.

2.0 Distinctive Features and its Rationale

Distinctive Features are the minimal distinctive units and the building blocks of speech sounds in phonological theory. The central idea behind distinctive feature theory is the notion that contrasts between phonemes can be described in terms of properties of segments rather than by treating segments as alphabetic atoms. Throughout the history of distinctive feature theory, a major goal has been to identify a set of features that is adequate for describing the segmental contrasts and phonologically important segment groups observed in the world's languages (Gussenhoven and Jacobs, 2017). Distinctive theory mainly tries to establish the phonetic details governing speech sounds and

segmental contrasts cross linguistically in an orderly fashion with the help of binary notation.

Ferdinand de Saussure viewed these contrasts between phonemes as the basic elements of systems of phonological oppositions. Saussure's insights were elaborated on by the Prague Circle during the 1930s. Many of the basic ideas of modern distinctive feature theory were laid out in Trubetzkoy (1969), which originally published in (1939), a year after his death. Trubetzkoy emphasized that phonological oppositions can be studied only as part of a system of oppositions and Roman Jakobson (1942) continued this work. Jakobson and Halle (1971) developed some of the theoretical points suggested in the earlier work, and Morris Halle used this feature system in an analysis of the phonological alternations of Russian (Halle, 1959). It was elaborated on by Noam Chomsky and Morris Halle in 'The Sound patterns of English' (1968). Chomsky and Halle's theory of generative phonology was a synthesis of Jakobson and Halle's theory of distinctive features and phonemic analysis, revised in the light of Chomsky's emphasis on formal explicitness, simplicity, and abstractness and autonomy of mental representations.

Since the inception of the phonological analysis of distinctive features in the 1950s, features traditionally have been specified by binary values to signify whether a segment is described by the feature; a positive value, [+], denotes the presence of a feature, while a negative value, [-], indicates its absence. In addition, a phoneme may be unmarked with respect to a feature. However, in recent developments to the theory of distinctive features, phonologists have proposed the existence of single-valued features. These features, called univalent or privative features, can only describe the classes of segments

that are said to possess those features and not the classes that are without them (Anderson, 1985).

Gussenhoven and Jacobs (2017) have talked about the three requirements imposed on a distinctive feature system which are:

1. They should be capable of characterizing natural segment classes.
2. They should be capable of describing all segmental contrasts in the world's languages.
3. They should be definable in phonetic terms.

Distinctive features allow the possibility of writing rules using a considerably smaller number of units than the phonemes of a language. All Jakobson's features were arguably equipollent, with two values, each characterising a definite property. Chomsky and Halle reinforced the features' binary nature, using plus and minus values in underlying representations, a positive value, [+], denotes the presence of a feature, while a negative value, [-], indicates its absence. So each speech sound may be described as a bundle of features and each member of every pair of phones differs from the other by at least one feature value. Distinctive features are grouped into categories according to the natural classes of segments they describe: major class features, laryngeal features, manner features, and place features.

The main foundations of Distinctive features are based on the construction of Natural Class. A Natural Class is a set of sounds that have certain phonetic features in common. All the members of a Natural Class are affected in the same way in the same environment. Similarly, all members of a natural class have the same effect on other sounds that occur in their environment.

For a group of sounds to constitute a Natural Class,

- they must all share one or more features and
- there should be no other sounds in the language that have this feature or combination of features. (Gussenhoven and Jacobs, 2017)

Natural classes are described by the minimum number of binary features [\pm] that all phonemes in the class bear, to the exclusion of all other sounds. Classes are defined by distinctive features having reference to articulatory and acoustic phonetic properties, including manners of articulation, places of articulation, voicing (pronounced with vibration of the vocal cords), and continuance (able to be lengthened in pronunciation).

For example, the phonemes [p, t, k,] can be grouped together as a natural class by showing the binary distribution of the features in Table 1. This distribution of features will distinguish these 3 sounds from all other phonemes in Standard English.

	syllabic	voice	continuant	delayed release
[p]	-	-	-	-
[t]	-	-	-	-
[k]	-	-	-	-

Table 1 Voiceless stops in Standard English

Further, the system of Chomsky and Halle defines the class of voiceless stops by the specification of two binary features: [-continuant] and [-voice]. Any sound with both the feature [-continuant] and the feature [-voice] is included in the class, thus specifying all and only the voiceless stops.

This implies that this class is also described as *not* having the features [+continuant] or [+voice]. This means that all sounds with either the feature [+continuant] or [+voice] are excluded from the class. This excludes all natural classes of sounds besides voiceless stops. For instance, it excludes voiceless fricatives, which have the feature [+continuant], voiced stops, which have the feature [+voice], and liquids and vowels, which have the features [+continuant] and [+voice].

Voiceless stops also have other, redundant, features, such as [+consonantal] and [-lateral]. These are not relevant to the description of the class and are unnecessary, since the features [-continuant] and [-voice] already include all voiceless stops and exclude all other sounds.

The distinctive features are classified into four groups (Halle and Clements, 1994):

1. Major Class Features: Four features [+/-syll], [+/-cons], [+/-son], [+/-cont] (syllabic, consonantal, sonorant, continuant) are used to divide up speech sounds into major classes. [+Syll] segments function as the nucleus of the syllable while their counterpart [-Syll] do not. Consonantal segments are pronounced with an audible constriction in the vocal tract. Sonorants have a periodic low frequency energy while continuants are produced with a continuous airflow in the vocal cavity.
2. Source features: These are related to the source i.e., the vocal fold vibration that sustains voiced sounds or a turbulent airstream that sustains voiceless sounds. It includes features like [+/-voice] – to indicate the vibration of the larynx, [+/- Spread glottis] – to distinguish aspirated and unaspirated sounds, etc.

3. Vowel Features: These include the four dimensions of vowel pronunciation, height [high] & [low] backness [back], rounding [round] and tensity [tense].

4. Place of Articulation: Features like [ant], [distr], [cor], [labial], etc are used in describing the place of articulation of a segment.

Just as the distinctive features help in grouping the natural classes of segments in an economic way, the construction of the Maheshwara Sutrani is done in an economic manner to emphasize the natural classes of the Sanskrit alphabet. It begins with short vowels, followed by diphthongs, which are followed by semi vowels, laterals, and nasals, followed by consonants depending on the place of articulation.

3.0 Maheshwara Sutrani and its principles of organization

Maheshwara Sutras, also known as Shiva Sutras, are the fourteen verses that organise the phonemes of Sanskrit in Panini's Ashtadhyayi. In the Sanskrit grammatical tradition, they are known as the *Akṣarasamāmnāya*, or the "recitation of phonemes," but they are popularly known as the *Shiva Sutras* because they are said to have been revealed to Pāṇini by the Hindu god Shiva. The practice of encoding complex rules in short, mnemonic verses is typical of the sutra style.

The 14 Maheshwara Sutras are :

<i>IAST</i>	<i>IPA</i>
1. <i>a i u Ṇ</i>	<i>ə i u ŋ</i>
2. <i>r ḷ K</i>	<i>ɹ ʌ k</i>
3. <i>e o Ṇ</i>	<i>e: o: ŋ</i>
4. <i>ai au C</i>	<i>a:i a:u c</i>
5. <i>ha ya va ra Ṭ</i>	<i>hə jə və rə ʈ</i>
6. <i>la Ṇ</i>	<i>lə ŋ</i>
7. <i>ña ma ña ṇa na M</i>	<i>ɲə mə ŋə ṇə nə m</i>
8. <i>jha bha Ṇ̄</i>	<i>.jʰə bʰə ŋ</i>
9. <i>gha ḍha dha Ṣ</i>	<i>gʱə ḍʱə ḍʱə ṣ</i>
10. <i>ja ba ga ḍa da Ś</i>	<i>jə bə gə ḍə ḍə ś</i>
11. <i>kha pha cha ṭha tha ca ṭa ta V</i>	<i>kʰə pʰə cʰə ʈʰə ʈʰə cə ʈə ʈə v</i>
12. <i>ka pa Y</i>	<i>kə pə j</i>
13. <i>śa ṣa sa R</i>	<i>ɕə ʂə sə r</i>
14. <i>ha L</i>	<i>hə l</i>

These Sutras put phonemes with a similar manner of articulation together (Ex: sibilants in 13 *śa śa sa R*, nasals in 7 *ñ m ñ ṇ n M*). Economy is a major principle of their organization, and it is debated whether Pāṇini deliberately encoded phonological patterns in them (as they were treated in traditional phonetic texts called Prāṭiśākyas) or simply grouped together phonemes which he needed to refer to in the *Aṣṭādhyāyī* and which only *secondarily* reflect phonological patterns, as argued by Paul Kiparsky in his *Economy and Construction of Maheshwara Sutras* (1991).

Each of the fourteen verses consists of a group of basic Sanskrit phonemes followed by a single 'dummy letter', or *anubandha*, conventionally rendered by capital letters in Roman transliteration and named '/iṭ/' by Pāṇini.

This allows Pāṇini to refer to groups of phonemes with *pratyāhāras*. *Pratyāhāras* are single syllables which consist of a phoneme and an *anubandha* (and often the vowel *a* to aid pronunciation) to signify all of the intervening phonemes.

Hence the *pratyāhāra* 'aL' refers to all phonemes (because it consists of the first phoneme of the first verse (*a*) and the last *anubandha* of the last verse (*L*)); 'aC' refers to vowels (i.e., all of the phonemes before the *anubandha* C: i.e. *a i u ṛ ḷ e o ai au*); 'haL' to consonants, and so on.

However, some of the *pratyāhāras* are ambiguous. The *anubandha* *Ṇ* occurs twice in the list, which means that you can assign two different meanings to *pratyāhāra aṆ* (including or excluding *ṛ*, etc.); in fact, both of these meanings are used in the *Aṣṭādhyāyī*. On the other hand, the *pratyāhāra* 'haL' is always used to imply "all consonants" – Pāṇini never uses *pratyāhāras* to refer to sets consisting of a single phoneme.

From the 14 verses of Maheshwara sutras, a total of 281 *pratyāhāras* can be formed: $14*3 + 13*2 + 12*2 + 11*2 + 10*4 + 9*1 + 8*5 + 7*2 + 6*3 + 5*5 + 4*8 + 3*2 + 2*3 + 1*1$, minus 14 (as Pāṇini does not use single element *pratyāhāras*) minus 10 (as there are 10 duplicate sets due to *h* appearing twice); the second multiplier in each term represents the number of phonemes in each (Kiparsky, 1991).

3.1 Maheshwara Sutras and Distinctive Feature Theory with Reference to Natural Class

Maheshwara sutras consists of fourteen sutras. Although at first glance they appear to be randomly organised; there is a definite pattern behind the organization of these sutras. The principles of Phonetic similarity and Natural Class are operating indirectly in the arrangement of the Paninian Sutras. The first four verses in the Maheshwara Sutras contain all the vowels of Sanskrit Language. Their feature matrix is: [+SYLLABIC, – CONSONANTAL, +SONORANT, +VOICE, +CONTINUANT]. However the diphthongs cannot be distinguished by these features but must be treated as a combination of vowel and a glide.

The fifth sutra is a collection of glides in Sanskrit. They can be represented as the natural class: [-SYLLABIC, -CONSONANTAL, +CONTINUANT].

The sixth verse contains a single element, a lateral.

The seventh sutra is the collection of all nasals of Sanskrit. This can be expressed in terms of the natural class: [-CONTINUANT, +SONORANT]

The sutras 8 to 12 are the collection of all stops, or plosives, of Sanskrit represented using the feature matrix: [-CONTINUANT, –SONORANT].

The thirteenth verse consists of the sibilants, represented as the matrix: [+CONTINUANT, – SONORANT, +SIBILANT]

The final sutra consists of a single element /h/ which is defined by its natural class: [- CONSONANT, -SONORANT, +CONTINUANT].

3.2 Maheshwara Sutras and Distinctive Feature theory in relation to Phonological patterns

The arrangement of the elements in the Maheshwara sutras is dependent on the place and manner of articulation of the elements. It starts with simple vowels followed by diphthongs, glides, laterals, nasals, plosives/stops, and fricatives.

However, the arrangement of plosives in five verses (sutras 8 to 12) do not correspond to any particular reason in terms of the Distinctive Feature theory since all of them belong to the same natural class. Same is the case with the arrangement of vowels in the first three verses. This could be explained in relation to hypothesis that Panini was more concerned about the principle of Economy rather than hierarchy. Panini simply grouped together phonemes which he needed to refer to in the *Aṣṭādhyāyī*, so the grouping of elements in the Maheshwara Sutras only *secondarily* reflect phonological patterns although a close introspection to the arrangement to the sounds grouped together in specific categories will indirectly provide the rationale and arrangement of the phonological patterns hidden therein. Most of the theories pertaining to Indian grammatical tradition focussed on precision and economy. Unlike the western theories which are mostly explicit and explanatory ancient Indian theories were highly suggestive and reflective.

4.0 Conclusion

This paper has made an attempt to throw light on Distinctive Feature Theory and Natural Classes along with Paninian sutras on an explicit canvas. The origin of the idea of Distinctive Feature theory which contributed a lot in the realm of Generative phonology can be traced back to Panini's organisation of Sanskrit phonemes in the form of 14 Maheshwara Sutras with reference to its principle of phonetic similarity governing the organization and arrangement of speech sounds. Paninian sutras didn't talk about the rationale behind the usage of binary values or the notation system with reference to the representation of speech segments in elaborate details nor did Panini make the distinction of sounds in terms of major class features, cavity features, manner features, laryngeal features in Maheshwara Sutras unlike the Distinctive Feature theory. However, a closer investigation into the arrangement of the speech sounds indirectly refer to a principle based on place and manner features. The arrangement of the phonemes of Sanskrit in the sutras is, to an extent, dependent on the distinctive features of those speech sounds, it is not entirely dependent on the Natural Classes, but relies on economy and their usage in describing the grammar of Sanskrit language as defined in his magnum opus, Ashtadhyayi.

In other words, one cannot conclude that Panini was unaware of the phonetic specifications and articulatory details involved in the production of phonetic categories. The discussion of the phonetic constructs such as svara (vowel), vijnana (consonants) and savarna (homogeneous) etc. used in these Sutras symbolize the underlying principle of phonetic similarity. The principle governing the organization of the sutras beautifully represents the phonetic nuances involved in different speech categories and it can be compared with the modern linguistic notion of phonetic similarity and pattern congruity in the western paradigm. The Maheshwara Sutras which precede Panini's Astadhyayi in the form of 14

sutras are not designed explicitly to provide phonetic details of speech sounds nor are they written for any prescriptive phonetic insight to designate member of a class in grammar; but they are conditioned by rule operations.

However, modern researchers of phonology cannot deny the presence of phonetic patterns in the sutras which further pave the way for principles in Astadhyayi and later Distinctive Features in the generative paradigm. There may not be one to one correspondence between Paninian Maheshwara sutras and Distinctive theory by Chomsky and Halle. While the Distinctive Feature theory is elaborate, Paninian Sutras are precise and economic. Distinctive Feature theory rejects the classical notion that phoneme is the minimal unit in the sound system of a language as it relies on the assumption that phonemes can be decomposed into features with reference to its either presence or absence of a certain feature in a unit. Paninian sutras mostly talks about the Sanskrit Phonemes and it does not give reference to its underlying features in terms of presence or absence. But as far as the arrangement of speech sounds are concerned there is an indirect reference to the place and manner features operating therein.

References

Anderson, S. R. (1985). *Phonology in the twentieth century: Theories of rules and theories of representations*. Chicago: Chicago University Press.

Chomsky, Noam.; Halle, Morris. *The Sound Pattern of English Studies in Language* .New York : Harper and Row, 1968

Ghosh, M. (1986). *Pāninīya 'Śikṣā or The Śikṣā Vedāṅga*. Delhi: Asian Humanities Press.

Gussenhoven, C., & Jacobs, H. (2017). *Understanding phonology*. Taylor & Francis.

Halle, M. (1959). *The sound pattern of Russian*. The Hague: Mouton.

Halle, M., & Clements, G. N. (1994). *Problem book in Phonology: A workbook for introductory courses in Linguistics and in Modern Phonology*. London: The MIT Press.

Jakobson, R., & Halle, M. (1971). *Fundamentals of language*. S-Gravenhage: Mouton.

Kiparsky, P. (1991). Economy and the Construction of Sivasutras. In: M. Deshpande and S.Bhate, ed., *Paninian Studies*. Ann Arbour, Michigan.

Thieme, P. (1935). *Panini and the Veda*. Allahabad: Globe Press.

Trubetzkoy, N. S. (1969). *Principles of phonology*. Berkeley: University of California Press.