
A phonological analysis of Bhopal Urdu has been presented in this thesis with the intent of showing that it is possible to explain the interrelationship in the paradigm of phonological units set up for Bhopal Urdu, and the non-random arrangement of these units in the syntagm. Although a vast amount of data was collected during the field work in Bhopal, the analysis is limited to the monosyllabic words in the dialect. The analysis is carried out and presented in terms of the five orientations as the principles of classification; namely, physiological mechanism, human behavior, communication, vision, and the acoustic medium.

The phonological analysis as motivated by the five orienting principles, was taken up in five chapters, with a brief introduction. The summary and the result of the analysis are presented here in three sections. Section A contains a brief summary of the phonological analysis of Bhopal Urdu as presented in the various chapters of the thesis. In section B, we take up the interaction of physiology, psychology, communication, and vision in Bhopal Urdu phonology, with a view to highlighting the fact that some of the phonological skewings in Bhopal Urdu can be explained in terms of more than one orienting principles. The conclusions with regard to the research presented in the thesis are given in section C.
Section A: Summary

It has been stated in the "Introduction" that our phonological analysis is based on the speech of the old city of Bhopal, and is limited to the exhaustively collected monosyllabic words of Bhopal Urdu. But the bisyllabic words have also been used in the illustrative examples for the validation of the analysis. We have also presented a brief theoretical background with regard to the five orienting principles of form-content linguistics.

In the first chapter, entitled "The Physiological Base of Bhopal Urdu Phonology," an attempt has been made to determine the role of the physiological mechanism in the make-up and distribution of phonological units of Bhopal Urdu. First we established the sixty-one phonological units of Bhopal Urdu in terms of articulators and apertures. The source of energy for their production is a current of air flow coming from the lungs. Bhopal Urdu phonological units were characterized in terms of eight articulators (labium, apex, medium, front dorsum, back dorsum, post dorsum, velum and glottis), and nine apertures (1, 2, 3, 4, 5, 6, 7 and 8). Degrees of apertures are subjected to two broad divisions. The first one divides the apertures into absolutely defined, smaller, constriction apertures (1-3), and relative larger opening apertures without any constriction (4-8). The second division draws a line between resonants (3-8) and non-resonants (1-2).

The phonological units of constriction were
further described in terms of degrees of constriction as stops, fricatives, nasals. Aperture 1 units were called stops, 1, 2, aperture units were labelled as 'fricatives'. Nasals were characterized in terms of two apertures (1+3), because nasals are produced on an interaction of aperture 1 and 3. Aperture 3 units and the nasals fall in between apertures 1, 2 and apertures 4-8, because they share constriction with the former and resonance with the latter.

We also dealt with the skewings in the combinatory patterns of phonological units in terms of the characteristics of the air current, and it was shown that combinations consisting of either of two phonological units with greater release of the air source or of two units involving strenuous release of the air source are not favored, since they involve uneven distribution of the air source. Inasmuch as aspirated consonants involve greater air use, they do not recur in a single syllable in Bhopal Urdu. Likewise, apertures, 0 and 1 involve abrupt and strenuous release respectively, therefore, their combination with one another requires greater air supply, therefore their use was minimized in Bhopal Urdu.

Explanation of the non-random character and distribution of phonological units was also provided through the asymmetry of the vocal tract. Due to the different biological functions of the vocal tract, it was different in shape and size. It has been shown that the asymmetry in the vocal tract has two significant ramifications on Bhopal Urdu Phonology. First, due to less space
in the back of the mouth (from dorsum to velum) as compared to the front of the mouth (from medium to hard palate), fewer vowel distinctions are possible at the back of the mouth. The less space at the back of the mouth was shown to be partially motivating the elimination of Standard Urdu vowels and their merger in Bhopal Urdu, though the elimination of standard Urdu vowels and their merger with neighboring vowels was mainly caused by the communicative factor. But here is a possibility that the low communicative load itself can be due to less space at the back. Because out of the eight eliminated and merged vowels ('four medial 'front' and four back dorsal 'back'), the communicative load of the back vowels (that is, back dorsal vowels) is in all cases the lowest.

Another skewing of Bhopal Urdu Phonology which was explained in terms of the asymmetry of the vocal tract, was the maximum use of teeth as point of articulation for the phonological units of aperture 1, 2. Due to lack as asymmetry in the vocal tract, unlike the alveolae or palate the teeth have a perforated surface. Since aperture 1, 2 involves releasing air through a narrow opening, the perforated surface of the teeth greatly intensify their acoustic quality. Furthermore, aperture 1 releases air through the most restricted channel; on aperture 1 only the teeth are used as point of articulation in contradistinction to aperture 2 where other points of contact or articulation are also used.

The hierarchy of mobility of lingual articulators
for consonants later in the chapter was also established in terms of their different mass and musculature. It is due to the triangular shape, being less massy and lying at the free side that the apex is the most mobile articulator. Owing to their rectangular shape and more flesh, medium and dorsum are less mobile. In fact, having the most complex musculature system, the medium of the tongue is the least mobile articulator among the apex, medium and dorsum. The root of the tongue was not included in this hierarchy because it is heavily tied to the base of the tongue and is the least mobile part of the tongue. De facto placement of the labium was also described. Given the musculature of the lower lip and the mobility of the lower jaw, the labium was placed below the apex and above the medium and near to the dorsum in terms of the hierarchy of mobility.

At the end of the chapter geared to the explanation of the non-random character of Bhopal Urdu Phonology in terms of the physiological mechanism, it was seen that due to their heavier mass only the medium and dorsum were used as articulator for the vowels, among the lingual articulators. Because unlike the consonants, in the production of vowels articulators do not excite the cavities but the only function of the articulator is to control the resonant cavities formed in the production of vowels. Due to the big size of the cavities, the heavier portion of the tongue (medium and dorsum) are physiologically
fit for the control.

"The Psychological Base of Bhopal Urdu Phonology", the second chapter of the thesis is geared to the explanation of the role of human behavior (Psychology) in the distribution of the phonological units of Bhopal Urdu on both the syntagmatic and paradigmatic levels. We took up the analysis of Bhopal Urdu Phonology in terms of human behavior in two parts. In the first part we dealt with the relative preference of gross articulatory movements over fine articulatory movements in the production of consonants, while in the second part we provided human behavior justifications for the Phonological Grid which was earlier established in terms of physiological mechanism in the first chapter.

In the first part it was established that the production of consonants required fine articulatory movement, if the consonants were produced by (1) the smaller and multidirectional changes of aperture over the larger and unidirectional changes of aperture, (2) the use of more articulators vis-a-vis fewer articulators, and (3) the use of an articulator at remote point of articulation rather than at proximate point of articulation. As was to be expected, the production of consonants with fine articulatory movement was disfavored in Bhopal Urdu.

It was shown with the help of the frequency count that large changes of aperture are preferred in Bhopal Urdu. For as the difference in the aperture increased from one consonant to the other in the word, so did the
number of words. Not only the larger change of aperture was preferred but aperture change in one direction was preferred to aperture change in more than one direction.

Disfavoring of multiple articulators was established by showing the favoring of phonological units produced by lesser number of articulators in the Urdu dialect under study. It is due to the multiplicity of articulators that the voiced consonants are less favored than the voiceless consonants, the aspirated consonants are disfavored vis-a-vis their unaspirated counterparts, and the nasalized vowels are less preferred than their oral counterparts.

Likewise the contact of apex at the palate (remote point) carries finer articulatory movement as compared to the contact of apex at teeth (proximate point). This difference in finer versus gross articulatory movement caused disfavoring of apico-palatal ("retroflex") consonants vis-a-vis apico-dental consonants in Bhopal Urdu. Avoidence of making contact at two different points with the same articulator at the beginning and end of the CVC words was seen in the total skewing in favor of an apico-palatal ("retroflex") consonant after an initial apico-palatal ("retroflex") consonant.

Preference for gross articulatory movement was also established in terms of greater preference for combination of two stable articulation or of two mobile articulation in a row vis-a-vis that of one stable and
one mobile or one mobile and one stable articulation; the preference for two stable or two mobile articulation in a row was said to be caused by the avoidance of an extreme physiological condition, which too demands fine articulatory movement. Preference for gross articulation is also measured by the assimilative traits of the neighboring phonological units, whereby contiguous phonological units tend to become like each other.

Later in the chapter, we also justified the make-up of the phonological Grid of Bhopal Urdu in terms of the preference for easy over rough articulatory movements. It was seen that the phonological units that were less complex in terms of multiplicity of articulators, relative tension of the articulator and the combining of two or more apertures in their production, outnumbered those that involved fine articulatory movements in terms of either multiplicity of articulators or relative tensions of the contact of the articulator at some remote point or using two apertures for a single unit.

The role of communication in Bhopal Urdu Phonology was taken up in chapter III. It was measured by examining the non-random character of the phonological units at both the syntagmatic and paradigmatic levels. At the paradigmatic level we gave the communicative justification for most of the phonological units in the phonological Grid (Diagram I-1). The so-called positional variants are not established through communicative criteria; they are established on the basis of the physiological
mechanism alone. The communicative based phonological units are established in terms of the phonemic contrast in minimal pair situations. Unlike the traditional phonemicists we use meaning in phonology without any apology, because meaning flows directly from communication, an orienting principle for phonological analysis.

At the syntagmatic level we dealt with four aspects of Jhopal Urdu Phonology. First it was shown that change in the order of the phonological units brings about change in meaning in CVC, CV and VC words. A second combinatorial aspect of Bhopal Urdu, explained in terms of communication, was the occurrence of phonological units in various positions of the word. We established through the frequency count that in terms of physiology and psychology there is general preference for voiceless consonants over the voiced consonants and for unaspirated consonants over their aspirated counterparts. Particularly to be noticed is the marked skewing in favor of voiceless unaspirated stops in comparison with the voiced aspirated stops. Likewise, oral vowels were shown to be favored over their nasalized counterparts. But as the figures clearly show, the tilt against voiced, aspirated consonants and nasalized vowels is greatly increased, word final position. The greater disfavoring for the complicated sounds at word final position is caused by the lesser communicative load of the phonological units at the non-initial position of the word.

The third combinatorial aspect of Bhopal Urdu
Phonology, explained in terms of communication is the occurrence of phonological units in the initial and final position of the word in terms of the hierarchy of mobility of articulators. We have demonstrated through the frequency counts that there is a much greater preference in word final position for the consonants produced by the physiologically most mobile articulator (apex), in comparison to the consonants produced by less mobile articulators (labium, dorsum, medium). The marked preference for the physiologically favored apical consonants in word final position is definitely motivated by lesser communicative need to utilize all phonological distinctions at the end of the word.

We also dealt with the effect on communication on the syntagmatic level of Bhopal Urdu Phonology by examining the contraction of some standard Urdu bisyllabic words into monosyllabic words in Bhopal Urdu. It had been shown that the syllabic reduction takes place by the drop of some medial or final phonological units. The non-initial location of the syllabic reduction can, therefore, only be explained in terms of the lesser communicative load of the phonological units in the medial and final positions of the word.

Later in the chapter we dealt with the merger of some standard Urdu phonological units in Bhopal Urdu. It had been shown that one consonant of Standard Urdu, namely ز, is lost and merged with the neighboring phonological unit ز in Bhopal Urdu. For the lost standard Urdu fricative
carries the least communicative load among the consonant, thence is prone to elimination and merger. Further, except for the standard Urdu h in non-initial position all other consonants of standard Urdu survived intact in Bhopal Urdu.

In contradistinction to consonantal merger, eight vowels of standard Urdu are eliminated in Bhopal and Urdu have merged with phonologically relevant vowels. The eliminated Standard Urdu vowels include four short vowels and four long vowels. The eliminated long vowels include ēː ēː ōː ōː. The eliminated long vowels have the lowest frequency among all the long vowels of standard Urdu. Therefore, the physiologically motivated elimination of these open vowels and their merger with the neighboring long vowels ēː ōː ōː ōː respectively can best be justified in terms of communication. Further, the loss of the open vowels and their merger with neighboring long vowels creates some homonyms, but most members of these homonymous pairs differ in their form classes.

The Standard Urdu short vowels that have been eliminated in Bhopal Urdu include e ē o ō. Besides having the lowest frequency among all the vowels, these four short vowels of standard Urdu are also limited in their occurrence to pre-h position. The elimination of these short vowels is thus precipitated by the loss of the following h and the compensatory lengthening of these short vowels to long vowels eː ōː ōː ōː respectively. The elimination of standard Urdu short vowels e ē o ō and their merger with their long counterparts eː ōː ōː ōː creates
some homonymous pairs, but the communication is in most cases facilitated by their differing form classes, since the majority of them have a difference in form class.

At the end of the chapter we also dealt with homonymy, with particular reference to the loss of quite a few phonological units of standard Urdu and their merger with the neighboring units in Bhopal Urdu. It was shown that despite the large percentage of homonymy, the communicative process is not hindered in Bhopal Urdu, for most of the homonymous pairs differ in form classes, and furthermore the remaining homonymous pairs can be set apart from each other in the context. Even further, communication in Bhopal Urdu is also facilitated by the fact that in case of some commonly used words, potential homonymy is avoided by some apparently ad hoc phonological changes from standard Urdu to Bhopal Urdu. Since the apparently sporadic phonological changes have been devised to keep the words of some potential homonymous pairs apart, these changes are fully justified in terms of communication.

In the fourth chapter, we dealt with the role of vision in Bhopal Urdu Phonology. It was demonstrated through the frequency counts that in view of its visibility, the labial articulator is more preferred at the initial position of the word (where a word requires most communicative distinction), than at the non-initial position of the word. In most cases of the monosyllabic words, labial consonants fell to the minimum in the final position of the word, while at the beginning they competed well with the
consonants produced by the most mobile articulator, the apex of the tongue.

The fifth, and the last chapter of the thesis highlights the value of acoustics in the phonological analysis. Our comments on Bhopal Urdu Phonology in terms of acoustics are based on received knowledge. We have presented the acoustic rationale for lip rounding of the back dorsal vowels in terms of the formant frequencies.

Section B: The Interaction

In the present work we have made an attempt to present the explanation of the non-random character and distribution of phonological units of Bhopal Urdu in terms of the five orienting principles of Form-Content Linguistics. The explanation of the non-random character of Bhopal Urdu phonological units in terms of these five orienting principles, was taken up in five chapters. But it has to be pointed out that these orienting principles are not separate entities, but interact with each other. In fact, it is the interaction of various orienting principles that produces various twists and turns in the phonology of a language.

There is an explicit or implicit relationship in the explanation provided under various heads in the thesis. It is beyond the scope of the present work to enumerate each and every instance of interaction encountered in the distribution of phonological units both syntagmatically and paradigmatically.
The interaction of the orienting principles can take any direction from the physiological mechanism to psychology or between physiology and acoustics and so on. An attempt is made in the following pages to review some important instances whereby two or more orienting principles are found to be interacting in providing justification for the observed asymmetry in the phonological pattern of Bhopal Urdu. As stated earlier our comments of acoustics received are based on knowledge, therefore we have not specified the interaction of acoustics with other orienting principles.

(1) In the rules of the physiological base given in Section I-A1, we postulated that the articulator is the source of the production of phonological units. In the second chapter in Section A3, preference for fewer articulators over more articulators was established. The preference for phonological units produced by fewer articulators was stated to be due to greater energy and coordination required to manipulate a greater number of articulators in simultaneity. It was the physiological feature (addition of articulators) that caused the disfavoring in terms of human behavior for phonological units produced by a greater number of articulators. It is due to the greater precision involved in the production of phonological units using more articulators, that voiceless stops and fricatives are preferred over voiced stops and fricatives, unaspirated consonants are preferred over aspirated consonants and oral vowels outnumber their
nasalized counterparts. (For details see section 3 of Chapter II). Since the articulator in terms of its mass and mobility is the determining feature involved in the production of phonological units, a fact clearly established in the physiological base, therefore all such instances whereby human preference or disfavoring for a certain unit or combination of units that is linked up to the manipulation of an articulator (or articulators) are evidence for the interaction of physiology and psychology.

In Chapter III Section B2, we studied the occurrence of phonological units in various positions of the monosyllabic words in Bhopal Urdu. It was seen that the disfavoring for complicated sounds is further increased in word final position where there is least communicative load. It was shown through tables that voiced, aspirated in consonants are more disfavored/word final position than in initial position. Likewise there is greater preference for oral vowels in word final position than at the initial position (see Section B2 of Chapter III). Therefore, we see that physiology and psychology interact to provide explanation of the distribution of phonological units, and that communication further justifies the disfavoring and favoring.

(2) It was stated in Chapter I Section B1 that aspiration is physiologically more difficult than any other act of the glottis (i.e voicing). Due to greater energy mobilization (use of the air supply) aspirated units do not occur twice in a syllable (I-31). In Section II-A3,
it was further stated that the preference for unaspirated consonants over their aspirated counterparts is also reinforced in terms of human behavior, favoring fewer articulators over more articulators. In fact there was greater difference in frequency count of aspirated and unaspirated stops than of voiceless and voiced stops. (cf. Tables II-6 and II-8). A particular skewing caused by complex manipulation of an articulator (physiology), can thus be explained in terms of human behavior (psychology) and it is termed as the interaction of physiology and psychology.

In Chapter III Section B2(i) and B2(ii) it was noted that not only the occurrence of aspirated consonants is less as compared to their unaspirated counterparts, but in the final position of the words, aspiration of the consonants is dropped without any hindrance of the communicative process. It is an instance of interaction of physiology and psychology with communication.

(3) It was established in chapter I Section B2 that there is a decrease in the amount of difficulty in the production of consonants in the syntagm with the increase in the aperture. In chapter II Section A6, we explained the enlargement of aperture for apico-palatal ("retroflex") consonants with an unfavorable point of articulation because enlargement in aperture decreases the difficulty. This is an instance of the interaction of physiology and psychology.
(4) It is the articulator that determines the articulation. Therefore the difficulty or ease in the production of a unit or combination of units is measured in terms of tension or laxness of the articulator. We could see the repercussions of this physiological trait in providing justification for the preference of apico-dental units over the apico-palatal. (Cf. Chapter II, Section A4 and A5). Here too we have an interaction of physiology and psychology.

(5) Furthermore, it is due to the quick and drastic adjustment of the coordination among articulators (which mainly determine the production of phonological units) that a combination of two stable or of two mobile articulator was preferred in a row for the production of consonants in the syntagm, over the combination of one stable and one mobile articulator or of one mobile and one stable articulator. (See Section A7, of Chapter II). This too is an instance of the interaction of physiology and psychology.

(6) In Chapter I Section D, it was shown that in combination with $\theta$-3 apertures, lingual articulators are preferred in the order of the hierarchy of mobility: apical, medial and dorsal. De facto placement of labium on the scale of mobility for the tongue was below the apex, above the medium, and close to the dorsum. It was later seen in Chapter III, Section B3 that the lesser communicative load of the phonological units at word final position
further increases the preference for apical consonants over labial, dorsal and medial consonants in that position. It is indeed an interaction of the physiological mechanism with that of communication which lessens the need for making all opposing distinctions in terms of articulators, in the final position of words, leaving the most mobile articulator, apex, to dominate the position.

(7) In Chapter III Section 32-34 it was shown that the initial position of a word carried greater communicative load than the final position. In the fourth chapter entitled 'Vision' we witnessed that labial articulator is used to the maximum in the production of consonants in words initial position, which carries most communicative load, and is reduced to the minimum in the word final position, which carries least communicative load. This is an instance of the interaction of communication and vision.

Section C: Conclusion

The present analysis of Bhopal Urdu is based on the assumption that phonological units of a language are tied to one another in a non-random relationship both paradigmatically and syntagmatically. These units are organized in terms of their physiological, psychological, acoustic and communicative bases in the paradigm and are characterized by a value relationship. The arrangement of phonological units in the syntagm is also determined by their physiological, psychological, communicative or
acoustic traits. In other words, phonological characteristics of a language are fully motivated by the orientations. The evidence that we have presented in validating phonological analysis of Bhopal Urdu, proves this point beyond reasonable doubt. Therefore, the thesis may not only contribute to our understanding of the inner mechanism of Bhopal Urdu Phonology, but also to our understanding of the theory of Phonology in general.

The thesis contains both theoretical and methodological innovations in the study of Bhopal Urdu Phonology. It abandons description in favor of explanation in terms of independently verifiable orientations, and presents quantitative procedures for validating the phonological analysis.