CHAPTER 1

PHYSIOLOGICAL BASE OF LUCKNOW URDU PHONOLOGY
CHAPTER-I

THE ROLE OF PHYSIOLOGY IN THE PHONOLOGY OF LUCKNOW URDU

The physiological analysis of Lucknow Urdu is presented in terms of the physiology of the vocal tract based on physiological mechanism, which is an orienting principle for the phonological analysis, in this chapter.

In this chapter, we make an attempt to highlight the physiological factors that play a role in the phonology of Lucknow Urdu like; (1) the role of physiology in the paradigmatic makeup of the phonological units: the phonological grid, (2) the paradigmatic and syntagmatic distributions of phonological units in terms of the hierarchy of the adroitness of the articulators, (3) the impact of the amount of energy utilized on the frequency of usage in the word in Lucknow Urdu.

We have divided this chapter into four sections. In Section A, we present the phonological grid of Lucknow Urdu, followed by explanatory comments on the various aspects of the paradigm. In Section B, we analyze the paradigmatic makeup and the syntagmatic distribution of the consonantal units in the word, in terms of the hierarchy of the
adroitness of articulators. In Section C, we analyze the impact of the amount of energy utilized in combinatory phonology. In Section D, we present summary with concluding remarks on the physiological aspects of the phonology of Lucknow Urdu.

Section A: Phonological Grid of Lucknow Urdu

The makeup of the phonological units in the paradigm are based on the physiology of the vocal tract, which plays a very important role. It is however to be noted that the phonological units of a language cannot be established in terms of physiological mechanism alone. Most of these units, traditionally called "phonemes" are in fact established by contrast through minimal and sub-minimal pairs in terms of communication. However, we deal with the phonological units in terms of their physiological makeup. The communicatively based phonological units, once established, are placed on the basis of their substance on the intersections of the relevant phonological axes, namely of articulators and apertures. Thus, we get a network of phonological units, established on the basis of physiology and communication. This network, which also includes some non-distinctive positional variants (to be discussed later on) is termed the phonological grid.
We present the phonological grid of Lucknow Urdu in Section A1, followed by brief comments in justification of the grid established in Section A2. We present a summary on the phonological grid as a paradigm in Section A3.

Section A1: Presentation of the Phonological Grid

A total of 61 phonological units have been postulated for Lucknow Urdu, which include 41 consonantal and 20 vocalic units. Keeping in mind the traditional terminology, we can classify the 41 consonantal units into 21 stops, 5 nasals, 8 fricatives and 7 liquids. Of the 20 vocalic units, 16 are monophthongs and 4 are diphthongs. The 16 pure vowels (monophthongs) consist of 6 short vowels (3 oral and 3 nasal), and 10 long vowels (5 oral and 5 nasal). In Diagram I-1 below, we present all the 61 phonological units of Lucknow Urdu.
Diagram I-11  The Phonological Grid of Lucknow Urdu
Section A2: Comments on the Phonological Grid

The phonological grid of Lucknow Urdu (cf. Diagram I-1) is to be fully explained in terms of its physiological features below.

It is to be noted that the phonological grid is established on the basis of four out of five orienting principles, namely, communication, human behaviour, physiological mechanism and acoustic medium. We will be limiting ourselves to only the physiological aspect in the establishment of the grid here.

1. Mechanics of Diagramming

The phonological grid presents the phonological units of Lucknow Urdu in the light of its physiological characteristics (Diagram I-1).

The grid presents units based on the vertical axis of the degrees of apertures and the horizontal axis of the articulators. The crossed and broken black line separates the constriction from openings, whereas the dotted and broken black line indicates the division between the consonants and vowels.

The phonological units are represented, or symbolized by both lower case and capital letters. N, V and A are
abstract units of N (asality), v (voicing) and A (aspiration) respectively.

The interrelationship between the phonological units is shown by the solid black line while the dotted black line indicates the voicing (coming from V on aperture 1 at glottis). The double broken black line shows the aspirated units in the grid (aspiration) coming from A on aperture-2 at glottis). The link between the nasal consonants and N on one hand, and between the nasalized vowels and N on the other hand is indicated by the broken black line.

The labio-dorsality of certain phonological units, is marked by the solid green line, which connects the labium with the back dorsum; phonological units made up of two apertures, with their base units at two apertures are highlighted by the broken green line. To be precise, the traditional "diphthongs", ai and au are connected to their base 'a' at aperture 7 and 'y' and 'w' at aperture-3.

Arrow, as in apex-teeth; and apex-palate, signifies that apex is the common articulator to establish contact with two points of articulation, the teeth and the hard palate.

Forks at aperture-3, signal that though the forked phonological units are at the intersection of the same
articulator and the same aperture, distinction has to be made in terms of their phonological makeup.

2. Constriction versus Opening

For Lucknow Urdu the constriction apertures stretch from apertures 0 through 2. They are smaller apertures and are characterized by noise produced by the narrow contact between the articulators and the points of articulation, hence ideally suited for stops, nasals and fricatives. As a result, the 21 stops, 5 nasals, and 8 fricatives are plotted on the constriction apertures for Lucknow Urdu. Since the degrees of apertures are narrow, they can be measured or labelled in exact or absolute terms. It is to be mentioned here that voicelessness is a basic feature on these constriction apertures. However, voiced units are also produced on these constriction apertures, but they advocate the use of an extra articulator (larynx).

In contradistinction, the opening apertures extending from 3 through the most open, are apertures of larger openings and are characterised by resonance due to a lack of contact or stoppage between the articulators and the points of articulation, hence ideally suited for liquids and vowels. The 5 liquids and 20 vowels (monophthongs and diphthongs) are plotted on these apertures for Lucknow Urdu.
These large apertures can be defined in relative terms only and not in absolute terms as for the smaller apertures. Mention is to be made, that voicing is a basic feature at these apertures, which is why we find all voiced units on these large apertures for Lucknow Urdu.

3. Consonants Versus Vowels

Following the phonological grid of Lucknow Urdu (cf. Diagram I-1), we see that a clear cut division can be made between the consonants and vowels by establishing a line of demarcation between aperture-3 and 4 (represented in the grid of Lucknow Urdu by the dotted and broken black line).

One division is for the aperture 0 through 3, under which we place the labial, nasal and fricative consonants. The second division for apertures 4 through 8 gives us the various categories for the vowels (short/long/oral/nasal, monophthongs/diphthongs, etc).

The constriction apertures (discussed in sub-Section-2) was limited, to apertures 0 through 2. But in this case we apply the bifurcation to apertures 0 through 3. This division is justified by the point that the contact between the articulators and the points of articulation is quite close in the production of phonological units. It may be noted that the turbulence within the oral cavity recedes as we move from aperture 2 to 3, but some excitation is
produced in the production of phonological units at aperture-3.

4. Phonemes Versus Phonological Units

The phonological units appear to be similar in their makeup when compared with the traditional "phonemes". The phonological grid shows apparent similarity with the makeup of the "phonemic inventory" of the American structuralists. It is however, important to enhance the fact that the phonological grid of Lucknow Urdu and the "phonemic inventory" of the American structuralists are different from one another.

In traditional American Phonemics, the "phonemic inventory" is a collection or listing of phonemes of a language. To be sure, this listing is presented with a reference to points of articulation and manner of articulation for the consonants, and in terms of the part of the tongue and height of the tongue raised for the vowels. However, the points of reference are merely labels to identify the individual phonemes. If there is any classification of the phonemes, that classification deals with a priori notion, such as "symmetry of pattern" or "economy " in the setting up of phonemes.

Unlike the "phonemic inventory", the phonological grid is organized in terms of articulators and apertures based on
physiologico-acoustic factors. The phonological units that actually fall at the intersection of the two axes, do have substance. But what is more important from our point of view, is the interrelationship of these units in the entire phonological grid. In other words, the phonological units of a grid are tied with one another in terms of value relationships which are most important in the paradigmatic makeup of the grid.

Regarding the phonological grid of Lucknow Urdu, the phonological units to be established in terms of physiological mechanism and communication, include all the "phonemes" (cf. "phonemic inventory", Diagram III-1) plus "allophones" of the "phonemes" that fall on the intersections of relevant axes, which are raised to the status of phonological units. The relevant axes of articulators and apertures yield 72 intersections for Lucknow Urdu. These intersections have not been randomly filled, which is apparent by the gaps or holes in the pattern. Of these 72 intersections only 61 are filled by phonological units. We have 5 positional variants for Lucknow Urdu, listed below, which have been raised to the status of phonological units.
Articulators
Apertures

Apex
Palate

Medium

All these 5 positional variants (traditional viewpoint) are considered as distinct phonological units when they are distributed and plotted in the phonological grid of Lucknow Urdu.

5. The Status of N, V and A as Phonological Units

Although N (nasality), V (oicing) and A (spirat ion), as well as the consonants and vowels, presented in the phonological grid of Lucknow Urdu are all abstract phonological units, the N, V and A are to be differentiated from other phonological units and their distinctiveness is established through physiology and communication in the paradigm. In contrast, N, V and A do not occur as separate individual entities in the speech chain. Instead, they are superimposed on the consonants and vowels in the phonological grid of Lucknow Urdu.

We may take up each separately below:

(i) Nasality: This phonological unit is established at the intersection of the articulator velum and aperture-3. The
lowering of the velum opens the nasal cavity, to produce N(asality), thus leading to the production of nasal phonological units in our grid of Lucknow Urdu (cf. Diagram I-1).

(ii) V(oiceing): This unit is established on the intersection of the glottal axis horizontally and aperture-1 vertically. Voicing to all phonological units which are labelled 'voiced' is provided by this.

Keeping in mind the phonological grid of Lucknow Urdu, we may point out that all phonological units of aperture-3 through B are produced in combination with V(oiceing). The voiced stops and nasals at aperture-Ø are also produced by this.

(iii) A(spiration): A is plotted at the intersection of glottis and aperture-2, horizontally and vertically respectively.

The voiceless aspirated stops of Lucknow Urdu are produced at aperture-Ø in combination with A(spiration) at aperture-2 (cf. Diagram I-1). The voiced aspirated stops of Lucknow Urdu are produced at aperture Ø with a combination of V(oiceing) from aperture-1 and A(spiration) from aperture-2.
The nasal consonants in the grid are produced by a combination of the necessary articulators at aperture-Ø and N(asality) at aperture-3.

The nasal vowels of Lucknow Urdu are produced with a combination of the relevant three-part dorsum at aperture-4 through 8, and a link with N(asality) at aperture-3. This is well projected in our phonological grid (Diagram I-1).

6. The Production of the Voiced-h

For details see Introduction, Section C2(aii).

7. Four-way Classification of Stops

The phonological grid of Lucknow projects a network of 21 stops, namely, p ph b bh, t th, d dh, ð ðh ðh dh c ch j jh, k kh g gh and q. It is interesting to note that these stops have a four-way classification. We have both voiceless stops (p ph, t th, ð ðh, c ch, k kh, q) and voiced stops (b bh, ð ðh, ð ðdh, j jh, g gh). Another classification is seen between the unaspirated stops (p b, t td, ð ðq, c j, k g and q) and the aspirated stops (ph bh, th dh, ðh dh, ch jh, kh gh) for Lucknow Urdu.

8. Units Formed with the Combination of Two Apertures

Some phonological units of Lucknow Urdu are produced by a combination of two apertures. These units are the
The diphthongs ai and au and their nasalized counterparts ñi and ñu respectively.

The diphthongs ai and ñi are a combination of the vowel a at aperture-7 and the semi-vowel y at aperture-3.
The diphthongs au and ñu are a combination of the vowel a at aperture-7 and the semi-vowel w at aperture-3.

9. Units with Two Articulators Labio-Dorsal Phonological Units

Some phonological units of Lucknow Urdu are produced with a combination of two articulators. This phenomena is apparent in some units at aperture-3 through 7. The semi-vowel w and the back vowels uːuː, oːoː, ûû are produced with a combination of back-dorsum and labium (resulting in lip-rounding). This phenomena is the result of the involvement of two articulators and the rationale behind it is based on acoustic factors. We have discussed this in our chapter on acoustics (cf. Chapter IV).

10. Distinct Units Formed at two Points of Articulation with the Same Articulator

Due to its extreme mobility, the apex of the tongue comes in contact with two distinct points of articulation to produce two series of dental stops. When apex blocks the
vocal tract at dentum, we produce the apico-dental stops. However, when we curl back the apex to block air passage at palatum, we produce apico-palatal stops or the traditional "retroflex stops in urdu".

Taking the case of Lucknow Urdu, and as is visible from its phonological grid (Diagram I-I), we can say that the apico-dentals (Apex-teeth) are t d, th dh and n. The apico-palatals (Apex-palate) are ṭ ḍ, ṭh ḍh and ṇ. Both the categories have the same articulator (apex) but clearly two points of articulation (teeth and palate).

**Apico-dental Versus Apico-alveolar**

Some phonological units at the apex dentum (apex-teeth) project variations in their points of articulation. The units s, l, r and n have points of articulation ranging from upper teeth to alveolar ridge. These units are apico-dental when they come before apico-dental stops. Elsewhere, these units may vary from apico-dental to apico-alveolar. Due to an absence of distinction between the apico-dental and apico-alveolar consonants, we set up only one axis, namely apico-dentum (apex-teeth) for Lucknow Urdu.

Regarding the point of articulation, it ranges from dentum to alveolum for the non-stop consonants under the apico-dental series, we may provide a paradigmatic (or a
communicative) rationale. As apparent from the phonological grid of Lucknow Urdu (Diagram I-1), the apico-dental stops are opposed to apico-palatal stops. The point of articulation for the two series are clearly maintained. In contradiction, to the apico-dental stops, the apico-dental s has no counterpart at the apico-palatal axis. The unit s is therefore in a position to extend its range from dentum to alveolum.

The remaining apico-dental units n, l and r have opposition with apico-palatal (retroflex) units ṇ, ḍ, ṟ. It is however, important to note that the frequency of the apico-palatals ṇ, ḍ, ṟ is very low because of its low functional load. (Parenthetically, it may be pointed out that the opposition between n l r and ṇ ḍ ṟ is non-distinctive).

11. **Phonetic Variants at Two Points of Articulation with the Same Articulator**

**Labio-labial Versus Labio-dental**

A look at the phonological grid (Diagram I-1) shows that the labio-dental fricatives f, v and the bilabial stops and nasals p, b, n etc. have all been classified under one articulator, the labium. However, they have two points of articulation, namely, the upper lip and the lower edges of
the upper teeth. The justification for a single axis is provided by the following points:

(a) The classification of the phonological units of Lucknow Urdu is carried out in terms of their respective articulators. The above mentioned units are produced by a single articulator (labium).

(b) There is no labio-dental axis in opposition to the bilabial axis for Lucknow Urdu. In the preceding section, we discussed two separate axes, apico-dental versus apico-palatal because the phonological units under these were in contrast with each other. This is however, not the case with labio-dental and bilabial consonants, here for, due to an absence of bilabial fricative 0 in Lucknow Urdu, we are unable to establish a contrast with the labio-dental fricative f.

(c) The perforated edges of the upper teeth act as ideal points of articulation for fricatives, which require friction. On the other hand, the tight contact of the upper lip are ideal articulators, and points of articulation for stop (and nasals) at aperture-Ø. Thus, we have a physiological rationale for the phonological unit f to be labio-dental.

*Ftn: In Indo-European when tenues become fricatives in Germanic the IE*p-f through the intermediary stage of Ø.
12. Vowels and the Non-apical Portion of the Tongue

It has already been mentioned in our introduction that the non-apical portions of the tongue are suitable for the production of vowels (cf. Introduction, Section Cl (aiv)). A look at the vowels of Lucknow Urdu clearly show a total skewing in favour of the "medial" and "dorsal" vowels, which is shown in Diagram I-2, below.

![Diagram I-2: Vowel System of Lucknow Urdu](image)

We see that the "medial" and "dorsal" vowels of Lucknow Urdu, are based on some physiological rationale (cf. Introduction, Section Cl(aiv)). The apical portion of the tongue which is less massy is less suited for the production of vowels. However, the roughly four dimensional more massy non-apical portion of the tongue, comprising of the medium and dorsum is ideally suited for the production of the
vowels of Lucknow Urdu. The shape and mass of the non-apical portions of the tongue provides a good resonating chamber which is needed for units articulated at higher apertures.

Section A3: Summary Statements

We can summarize the whole of section-A as follows:

1. In this Section, we have limited our scope to the makeup of the phonological units in the paradigm.

2. The phonological grid of Lucknow Urdu presented in section-A1, is a systematic presentation of all the phonological units which are established on the intersections of the relevant axes of articulators and apertures.

3. The phonological units, presented in the grid, are physiologically motivated. The phonetic substance of these units is determined by their articulatory characteristics.

4. The phonological grid also indicates the phonological value of the units when it highlights the interrelationship of these units.

5. The 61 phonological units of Lucknow Urdu, 41 consonantal and 20 vocalic (monophthongs and diphthongs) are plotted systematically on the
intersections of the physiological axes of articulators and apertures.

6. In Section A2, we have offered further comments on the phonological grid of Lucknow Urdu.

Section B: The Hierarchy of the Adroitness of the Articulators: The Makeup and Distribution of Consonants

It has been discussed in our Introduction (Section C2(aiii), that the apex occupies the top position in the hierarchy of adroitness among the lingual articulators, followed by the dorsum, the medium and the post dorsum (or the root) in that order. It may also be mentioned that we also made a defacto placement of the labium on the scale of adroitness of articulators. In view of the musculature of the lower lip and the mobility of the lower jaw, we had a fairly good reason to place the labium somewhere close to the dorsum in terms of its adroitness, definitely below the apex and above the medium.

The paradigmatic makeup and the syntagmatic distribution of the phonological units at apertures 0 through 3 are affected by the hierarchy of the adroitness of the articulators. That is, the impact of this hierarchy is restricted only to the consonantal units ("stops", "fricatives", "liquids" and "nasals"). In view of this
greater mobility of the apex as the most adroit articulator, we expect that the apical consonants should be favoured. The labial and the dorsal consonants produced by the more adroit labium and the dorsum, though less favoured than the apical consonants, should be more favoured than the medial consonants which are produced by the comparatively less adroit medium of the tongue. The post dorsal consonants produced by the least adroit post dorsum should be least favoured.

In Section B1, we examine the effect of the hierarchy of the adroitness of the articulators on the number of consonantal units in the paradigm. In Section B2, we deal with the impact of the hierarchy of adroitness on the frequency of occurrences of the consonantal units in the monosyllabic words in Lucknow Urdu. In Section B3, we give concluding remarks on the entire section.

Section B1: Paradigmatic Makeup and the Number of the Phonological units in Terms of the Hierarchy of the Adroitness of the Articulators

It has been stated earlier that the apex is the most adroit among the lingual articulators. Given the high adroitness of the apex, we expect its optimum use in the production of consonantal units. As a result of this
adroitness we expect the number of apical consonantal units to be highest. On the other hand we also expect the post dorsal consonantal units to be lowest in number.

This section is an attempt to validate our claim and to examine the impact of the hierarchy of the adroitness of the articulators on the paradigmatic makeup and number of the phonological units. In Diagram I-3, we present the phonological units in terms of the hierarchy of the adroitness of articulators.
<table>
<thead>
<tr>
<th>Aperture</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Articulators</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teeth</td>
<td>t d; th dh, n</td>
<td>s z l r</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17</td>
</tr>
<tr>
<td>Palate</td>
<td>t d; th dh n</td>
<td>l r l rh</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labium</td>
<td>p b; ph bh m f v</td>
<td>w</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dorsum</td>
<td>k g; kh gh n</td>
<td>x v g w</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>c j; ch jh n</td>
<td>y</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-Dorsum</td>
<td>q</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

G. Total | 41 |

Diagram I-3: **Hierarchy of the Adroitness of Articulator and the Makeup of Consonantal Units.**
A total of 17 consonantal units are produced by the highly adroit apex. This consists of 9 apico-dental and 8 apico-palatal units. The labium and the dorsum produce 8 units each (including the labio dorsal liquid w), while the medium is instrumental in the production of 7 consonantal units. As the post dorsum (root of the tongue) is the least adroit, we encounter only 1 unit at that axis at aperture 0 through 3.

We can see from the figures that the apex tops the list of the articulators in order of hierarchy of adroitness by producing the maximum number of units. Our claim of the apex being the most adroit articulator is also reinforced by the fact that the apex comes in contact with two separate, distinct points of articulation, namely the teeth and the palate to produce two series of stops and liquids (apico-dentals and apico-palatals). Thus, here again, the apex projects a wider range in terms of place of articulation.

It is interesting to note that the number of the apical consonants is almost double the number of the labial, dorsal or medial consonants. Although there is a minute difference in the number of the dorsal and medial consonants, the disfavourings for the medial consonants clearly shows up in
the frequency of usage in the word in Lucknow Urdu (cf. Section B2).

**Section B2: Syntagmatic Usage of the Consonantal Units in Terms of the Hierarchy of the Adroitness of the Articulators**

This section contains an assessment of the hierarchy of the impact of the adroitness of articulators and the frequency of occurrence of the consonantal units in Lucknow Urdu. Given the hierarchy of adroitness (apex, labium-dorsum, medium and post dorsum), we expect that the apical consonants should be most preferred, to be followed by the labial-dorsal, medial, and post dorsal consonants, in their frequency of occurrence in the word. We assess the impact of the hierarchy of articulators on the distribution of consonantal units in the word through statistical support. We have presented this quantitative assessment in six subsections below.

In Section B2(a), we examine the effect of the hierarchy of articulators on the consonantal units in their entirety. In Sections B2(b), B2(c), B2(d), and B2(e), we evaluate the impact of this hierarchy on the "stops", "fricatives", "liquids" and "nasals" respectively. In Section B2(f), we present concluding remarks with regard to the effect of the hierarchy of the articulators on the
syntagmatic distribution of phonological units in Lucknow Urdu.

Section B2(a): Consonantal units in Terms of the Articulators in the Hierarchy of Adroitness

Here, we assess the effect of the hierarchy of the adroitness of articulators on the frequency of occurrence of all the consonants in Lucknow Urdu. The relative frequency of the opposing consonantal units is given in Table I-1.
<table>
<thead>
<tr>
<th>Consonantal Units (Apertures $\emptyset 1,2,3$)</th>
<th>CVC</th>
<th>CVCC</th>
<th>CCVC</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Articulators</strong></td>
<td>No/%</td>
<td>No/%</td>
<td>No/%</td>
<td>No/%</td>
</tr>
<tr>
<td>Apico-Dental</td>
<td>1109/74.78</td>
<td>133/88.67</td>
<td>8/100</td>
<td>1250/76.17</td>
</tr>
<tr>
<td>Apico-Palatal</td>
<td>374/25.22</td>
<td>17/11.33</td>
<td>391/</td>
<td></td>
</tr>
<tr>
<td>Apical</td>
<td>1483/48.38</td>
<td>150/55.97</td>
<td>8/34.78</td>
<td>1641/48.9</td>
</tr>
<tr>
<td>Labial</td>
<td>633/20.65</td>
<td>45/16.79</td>
<td>5/21.74</td>
<td>683/20.30</td>
</tr>
<tr>
<td>Dorsal</td>
<td>524/17.10</td>
<td>25/9.33</td>
<td>4/17.39</td>
<td>553/16.49</td>
</tr>
<tr>
<td>Medial</td>
<td>405/13.21</td>
<td>41/15.30</td>
<td>6/26.09</td>
<td>452/13.47</td>
</tr>
<tr>
<td>Post-Dorsal</td>
<td>20/0.65</td>
<td>2/2.61</td>
<td>7/ --</td>
<td>27/0.80</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>3065/100</td>
<td>268/100</td>
<td>23/100</td>
<td>3356/100</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td></td>
<td></td>
<td></td>
<td>3356</td>
</tr>
</tbody>
</table>

Table I-1: Frequency of Occurrence of the Consonantal Units in the Monosyllabic Words in Terms of Articulators.
Comments on the Table:

Of a total of 3356 occurrences of consonants (stops, fricatives, liquids, nasals combined), 1641 (48.90%) are apical, 688 (20.35%), labial, 553 (16.48%) dorsal, 452 (13.47%) medial and 27 (0.80%) post dorsal. This distribution of consonantal units is clearly in accordance to our expectation in terms of the hierarchy of the adroitness of articulators.

It is to be noted that almost half the consonantal occurrences are produced by the most adroit articulator, the apex alone.*

As expected, apical consonants top in the frequency of usage followed by the labial and the dorsal consonants. It is not a coincidence that there is a fair competition between the labial and the dorsal consonants. For labium and dorsum occupy almost the same position on the scale of adroitness of articulators.

*Ftn: Among the apical consonants, there is a skewing in favour of the apico-dental 1250 (76.17%) in comparison with the apico-palatal ("retroflex") 341 (23.83%). The rationale for this skewing is to be found in the human trait of preferring the proximate point of articulation over the remote point articulation. (cf. Chapter II, Section B).
It is seen that as expected the frequency of usage for the medial consonants goes down further, as these consonants are produced by the less adroit medium. There is a drastic skewing against the post dorsal consonants, which account for a mere fraction of the percentage for the total number of consonantal units. This skewing against the post dorsal consonants is justified, for they are produced by the least adroit post dorsum.

2. For the CVC words, we again encounter the expected skewings in the occurrences of the consonantal units in consonance with the hierarchy of the adroitness of articulators. The apical consonants produced by the most adroit apex, account for almost half of the total occurrence of consonantal units in these words.

Of the 3065 consonantal occurrences in these words, there are 1483 occurrences of the apical consonants alone.

Although they are much less frequent than the apical consonants, the labial consonants 633 (20.65%) and the dorsal consonants 524 (17.10%) compete well with each other, which is what we expect in view of their parallel placement on the scale of the adroitness of articulators.

As expected, the frequency of the medial consonants 405 (13.21%) goes down further followed by the post dorsal
consonants $20 (0.65\%)$, which is justified in that they are produced by the least adroit post dorsum.

3. Of a total of 268 CVCC words, the apical consonants, account for more than half of the total frequency of occurrence $150 (55.97\%)$, because they are produced by the most adroit apex.

The difference between the apical consonants, the labial consonants $45 (16.79\%)$, and the dorsal consonants $25 (9.33\%)$ conforms to our expectations regarding the hierarchy of articulators.

The figures for the medial consonants $41 (15.30\%)$, however, do not conform to the principles of this hierarchy. This sudden upsurge in the frequency of occurrence of the medial consonants here, lies in the fact that most of these words are Perso-Arabic loan words and have retained their original form in the usage in the word.

4. Of a total of 23 CCVC occurrences, we encounter a total of 8 apicals. The frequency of occurrence of the labials $5 (21.74\%)$ and dorsal $4 (17.39\%)$ consonantal units show a receding usage in comparison to the apical consonants which is what we expect. We, however, encounter a rise in the frequency of usage of the medial units. The rationale for this is provided in the explanation that for Lucknow
Urdu, the second member of the CCVC cluster is either the medial w or y which is to be found in words like pyaːr 'love'

kyaː 'what'
dwair 'door' etc.

Thus we see that the figures and their percentages clearly show skewings in favour of the consonants produced by the most adroit apex, followed by the consonants produced by the more adroit labium dorsum, the medial consonants produced by less adroit medium and the post dorsal consonants produced by the least adroit post dorsum.

Notwithstanding the above statistics, we also encounter a few unexpected skewings which do not conform to the order of this hierarchy of adroitness. We have however, provided suitable rationale for these skewings.

Section B2(b): Stops in Terms of the Articulators in the Hierarchy of Adroitness:Aperture Ø

In this section we assess the effect of the hierarchy of the adroitness of articulators on their frequency of occurrence for the apical, labial, dorsal, medial and post-dorsal stops for the CVC, CVCC and the CCVC words.

In Table I-1(a) below, we present the proportional occurrences of the above mentioned stops.
<table>
<thead>
<tr>
<th>Articulators</th>
<th>CVC</th>
<th>CVCC</th>
<th>CCVC</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No/%</td>
<td>No/%</td>
<td>No/%</td>
<td>No/%</td>
</tr>
<tr>
<td>Apico-Dental</td>
<td>323/</td>
<td>43/</td>
<td>2/</td>
<td>368/</td>
</tr>
<tr>
<td></td>
<td>52.44</td>
<td>81.13</td>
<td>100</td>
<td>54.84</td>
</tr>
<tr>
<td>Apico-Palatal</td>
<td>293/</td>
<td>10/</td>
<td>-</td>
<td>303/</td>
</tr>
<tr>
<td></td>
<td>47.56</td>
<td>18.86</td>
<td></td>
<td>45.16</td>
</tr>
<tr>
<td>Apical</td>
<td>616/</td>
<td>57/</td>
<td>2/</td>
<td>671/</td>
</tr>
<tr>
<td></td>
<td>32.96</td>
<td>44.54</td>
<td>25.00</td>
<td>33.62</td>
</tr>
<tr>
<td>Labial</td>
<td>442/</td>
<td>23/</td>
<td>5/</td>
<td>470/</td>
</tr>
<tr>
<td></td>
<td>23.65</td>
<td>19.33</td>
<td>62.5</td>
<td>23.55</td>
</tr>
<tr>
<td>Dorsal</td>
<td>444/</td>
<td>19/</td>
<td>1/</td>
<td>464/</td>
</tr>
<tr>
<td></td>
<td>23.76</td>
<td>15.97</td>
<td>12.5</td>
<td>23.25</td>
</tr>
<tr>
<td>Medial</td>
<td>347/</td>
<td>17/</td>
<td>-</td>
<td>364/</td>
</tr>
<tr>
<td></td>
<td>18.57</td>
<td>14.29</td>
<td></td>
<td>18.24</td>
</tr>
<tr>
<td>Post-Dorsal</td>
<td>20/</td>
<td>7/</td>
<td>--</td>
<td>27/</td>
</tr>
<tr>
<td></td>
<td>1.07</td>
<td>5.88</td>
<td></td>
<td>1.35</td>
</tr>
<tr>
<td>Total</td>
<td>1869/</td>
<td>119/</td>
<td>8/</td>
<td>1996/</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Grand Total</td>
<td></td>
<td></td>
<td></td>
<td>1996</td>
</tr>
</tbody>
</table>

Table I-1(a): Frequency of Occurrence of Stops in the Monosyllabic Words in Terms of Articulators.
Comments on the Table:

1. A look at the table shows that there are a total of 1196 occurrences of stops in the monosyllabic words. Out of these the apicals 671 (33.62%) top the list, followed by the labial 470 (23.55%) the dorsal 464 (23.25%), the medial 364 (18.24%), and the post dorsal stops 27 (1.35%) in descending order. The figures and their respective percentages adequately suit out expectations regarding the effect of the hierarchy of the adroitness of articulators on the frequency of occurrence of the monosyllabic stops.

2. A cursory glance at the figures and percentages for the CVC stops show that they conform to our expectations. The apical stops 616 (23.96%) outnumber the almost equal labial stops 442 (23.65%) and the dorsal stops 444 (23.76%), which is what we expect.

The medial stops, produced by the less adroit medium, account for 347 (18.57%) which is justified.

The comparatively low figure for the post dorsal stops 20 (1.07%) is justified by the fact that they are produced by the least adroit post dorsum among the lingual articulators.

3. Of a total of 119 CVCC stops, the apical stops 53 (44.54%) comprise almost half of the total number of
occurrence, which are followed by the labial stops 23 (19.33%), the dorsal stop 19 (15.97%), the medial stops 17 (14.29%) and the post dorsal stops 7 (5.88%) which is what we expect as a result of this hierarchy.

4. We have a total of 8 occurrence for the CCVC stops. Out of these 8, 2 (25.00%) are apicals, 5 (62.50%) are labials and 1 (12.5%) are dorsal stops. The unexpected increase in the percentage of the labial stops gives us a skewing which goes against our expectations for this hierarchy. The rationale for this skewing can be explained in terms of vision (cf. Chapter V). Vision as an orienting principle dictates that in view of its visibility the labial articulator is more preferred, especially in the word initial position.

Section B2(c): Fricatives in Terms of the Articulators in Hierarchy of Adroitness: Apertures $1$ and $2$

In this section, we discuss the effect of the hierarchy of the adroitness of the articulators for the fricatives in the monosyllabic words through Table I-1(b).
Table I-1 (b): Frequency of Occurrence of Fricatives in the Monosyllabic Words in Terms of Articulators.
Comments on the Table:

1. Of a total of 425 words, we encounter 259 (60.94%) of apical fricatives, 52 (12.24%) of the labial fricatives, 48 (11.29%) of dorsal fricatives and 66 (15.53%) of medial fricatives. All figures favour our expectations except for the comparatively high medial fricatives. The rationale for this will be provided in our comments below. We also find a total skewing against the apico-palatal fricatives, for which we have already provided a rationale in our footnote in Section B2(a).

2. Of a total of 351 CVC fricatives, we encounter 223 (52.97%) apicals which is more than half of the total percentage. This is justified in that they are produced by the most adroit apex.

   The almost parallel figure for the labial and the dorsal fricatives also conform to our expectations.

   The medial fricatives are 49 (11.64%), which results in an unexpected rise in their usage in the word. This skewing against the medials in terms of the hierarchy of the articulators is accountable to the fact that we have a proportionable number of Perso-Arabic words in Lucknow Urdu which have remained unchanged.
3. Of a total of 71 CVCC fricatives, we have 34 (47.89%) apical fricatives which are produced by the most adroit apex.

The labial fricatives are only 14 (19.72%) which is justified and the comparatively low dorsal fricatives 6 (8.45%) are also justified in that they are produced by the dorsum of the tongue.

The medial fricatives 17 (23.94%), however, show an upward trend which is explainable by the fact that most of these CVCC words are Perso-Arabic and have remained unchanged in their usage in the word.*

4. We encounter a total of 3 occurrences in the CCVC words. Out of these 3 occurrences, the apical fricatives account for more than half of the total i.e. 2 (66.67%), which is perfectly justified by the fact that they are produced by the most adroit apex among the lingual articulators.

We have only one occurrence for the dorsal fricative, which is produced by the more adroit dorsum.

*Ftn. The sudden rise for the CVCC monosyllabic fricatives in their frequency of usage is also a resultant of the high number of Perso-Arabic words in Lucknow Urdu.
We however, get a total skewing at the medial and post dorsal order. This further justifies and validates our claim that the medial and post dorsal units will be less and least preferred respectively, in terms of the hierarchy of the adroitness of the articulators.

Section B2(d): Liquids in Terms of the Articulators in the Hierarchy of Adroitness: Aperture 3

In this section, we assess the effect of the hierarchy of the adroitness of articulators on the frequency of occurrence of the monosyllabic liquids through Table I-1(c).
<table>
<thead>
<tr>
<th>Articulators</th>
<th>CVC</th>
<th>CVCC</th>
<th>CCVC</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apico-Dental</td>
<td>379/</td>
<td>34/</td>
<td>3/</td>
<td>416/</td>
</tr>
<tr>
<td></td>
<td>78.79</td>
<td>100</td>
<td>100</td>
<td>80.31</td>
</tr>
<tr>
<td>Apico-Palatal</td>
<td>81/</td>
<td>--</td>
<td>--</td>
<td>81/</td>
</tr>
<tr>
<td></td>
<td>16.83</td>
<td></td>
<td></td>
<td>15.64</td>
</tr>
<tr>
<td>Apical</td>
<td>460/</td>
<td>34/</td>
<td>3/</td>
<td>497/</td>
</tr>
<tr>
<td></td>
<td>95.63</td>
<td>100</td>
<td>27.27</td>
<td>94.49</td>
</tr>
<tr>
<td>Labial</td>
<td>6/</td>
<td>--</td>
<td>--</td>
<td>6/</td>
</tr>
<tr>
<td></td>
<td>1.25</td>
<td></td>
<td></td>
<td>1.14</td>
</tr>
<tr>
<td>Dorsal</td>
<td>6/</td>
<td>--</td>
<td>2/</td>
<td>8/</td>
</tr>
<tr>
<td></td>
<td>1.25</td>
<td></td>
<td>18.18</td>
<td>1.52</td>
</tr>
<tr>
<td>Medial</td>
<td>9/</td>
<td>--</td>
<td>6/</td>
<td>15/</td>
</tr>
<tr>
<td></td>
<td>1.87</td>
<td></td>
<td>54.55</td>
<td>2.85</td>
</tr>
<tr>
<td>Post-Dorsal</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Total</td>
<td>481/</td>
<td>34/</td>
<td>11/</td>
<td>526</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Grand Total</td>
<td></td>
<td></td>
<td></td>
<td>526</td>
</tr>
</tbody>
</table>

Table I-1(c): Frequency of Occurrence of Liquids in the Monosyllabic Words in Terms of Articulators.
Comments on the Table:

1. Among the liquids at aperture-3, we have a total of 526 occurrence of the monosyllabic words of Lucknow Urdu. The apicals comprise a major chunk of the total i.e. 497 (94.49%) which shows that there is a clear preference for the apical liquids as compared to the labial, dorsal, medial and a total skewing against the post dorsal liquids. There is however an increase in the number of medial liquids which is 15 (2.85%) when compared to the dorsal liquid which is only 8 (1.52%). The rationale for this skewing is provided by the fact that in initial clusters the second member is either a 'y' or a 'w' in Lucknow Urdu.

2. Among the CVC liquids, all figures conform to our expectations regarding the effect of the hierarchy of the adroitness of the articulators except the unusual increase in the usage of medial liquid y as compared to the more preferred labio-dorsal w. This sudden increase in the medial consonant and a drop in the labio-dorsal w can be explained in terms of the human trait of preferring fewer articulators over more articulators (cf. Chapter II, Section A). Due to inherent human trait to minimize and economize efforts in all situations, the preference given to the fewer articulators over those using more articulators is
inevitable. In as much as the medial liquid involves two articulators (palate+glottis), and the labio-dorsal involves three articulators (labium+dorsum+glottis), the phonological units employing few articulators are preferred. The medial liquid y which is preferred over the labio-dorsal w.

3. The CVCC liquids show a massive skewing in favour of the apical liquids. Out of a total of 34 CCVC liquids, all comprise on the apical units. There is total skewing against the use of the labial, dorsal, medial and post dorsal liquids here.

4. Amongst the CCVC words, the apicals and dorsals are however outnumbered by the use of the medial liquid which amounts to more than half of the total percentage i.e. 6 (54.55%). The rationale for this skewing can be seen in the fact that in the CCVC clusters, ‘w’ and ‘y’ are preferred as the second member of the cluster, which is why the frequency of occurrence of the medial liquid increases.

Section B2(e): Nasals in Terms of the Articulators in the Hierarchy of Adroitness: Aperture Ø and 3

Here we assess the effect of the hierarchy of the adroitness of the articulators on the frequency of the occurrences of the apical, labial, dorsal, and medial nasals amongst the monosyllabic words through Table I-1(d).
<table>
<thead>
<tr>
<th>Nasals (Apertures Ø &amp; 3)</th>
<th>CVC</th>
<th>CVCC</th>
<th>CCVC</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Articulators</td>
<td>No/%</td>
<td>No/%</td>
<td>No/%</td>
<td>No/%</td>
</tr>
<tr>
<td>Apico-Dental</td>
<td>184/100</td>
<td>22/75.86</td>
<td>1/100</td>
<td>207/96.73</td>
</tr>
<tr>
<td>Apico-Palatal</td>
<td>-- 24.13</td>
<td>7/3.27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apical</td>
<td>184/50.55</td>
<td>29/65.91</td>
<td>1/100</td>
<td>214/52.32</td>
</tr>
<tr>
<td>Labial</td>
<td>147/40.38</td>
<td>8/18.18</td>
<td>--</td>
<td>155/37.90</td>
</tr>
<tr>
<td>Dorsal</td>
<td>33/9.07</td>
<td>--</td>
<td>--</td>
<td>33/8.07</td>
</tr>
<tr>
<td>Medial</td>
<td>-- 15.91</td>
<td>7/1.71</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-Dorsal</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Total</td>
<td>364/100</td>
<td>44/100</td>
<td>1/100</td>
<td>409/100</td>
</tr>
</tbody>
</table>

| Grand Total              | 409 |

Table I-1(d): Frequency of Occurrence of Nasals in the Monosyllabic Words in Terms of Articulators.
**Comments on the Table:**

1. A look at the total figures for the apical, labial, dorsal and medial nasals show the preference for the apical nasals followed by the labials, dorsals and the medials. The apicals produced by the most adroit apex, comprise more than half of the total number and percentages here, 214 (52.32%).

   The labials 155 (37.90%), the dorsals 33 (8.07%) and the medials 7 (1.71%) conform to our expectations regarding this hierarchy of the adroitness of articulators.

2. Even amongst the CVC nasals, the apicals are contributing to more than fifty percent of the total figures which is in favour of our expectations in terms of the hierarchy of the adroitness of articulators.

3. We encounter almost the same results for the CVCC nasals, where out of a total of 44 occurrences, the apicals comprise 29 (65.91%) which is more than half of the total.

   The labial nasals occur in 8 (18.18%) of the total occurrences followed by the medial nasals which are 7 (15.91%) which is what we expect in terms of the hierarchy of articulators.
4. And finally, a look at the figures for the CCVC nasals show a total skewing in favor of the apical nasals in contrast to a total skewing against all the rest of the nasal units. This is justified in that they are produced by the most adroit apex among lingual articulators.

Section B2(f): Concluding Remarks.

To sum up section B2 as a whole we present a few concluding remarks here:

1. The hierarchy of the adroitness of articulators has an impact on the syntagmatic distribution of consonantal units in Lucknow Urdu.

2. As a result of the hierarchy of the adroitness, we expect the apical consonants to be most preferred, followed by the labial-dorsal, medial, and the post dorsal, consonants in descending order. To validate our claim, we have taken the help of statistical data.

3. The figures and percentages clearly show that the apical consonants produced by the most adroit apex are most preferred in their syntagmatic usage in the word, followed by the labial-dorsal consonants produced by the more adroit labium and the dorsum, respectively the medial consonants produced by the less adroit medium
and the post dorsal consonants produced by the least adroit post dorsum (root of the tongue) in this order.

5. It may be parenthetically remarked that among the apicals, we encounter skewings which either totally or partially favour the apico-dental consonants, in comparison to the apico-palatal consonants. This skewing can be explained in terms of the human behaviour trait, whereby proximate points of articulation are preferred over remote points of articulation (cf. Chapter II, Section B).

6. We have also encountered instances when we have unexpected high figures for the less favoured medial consonants. We have provided suitable rationale for such type of skewings.

7. To conclude, we can say that the impact of the hierarchy of the adroitness of articulators gives us massive skewings in favour of the apical consonants, followed by the labial-dorsal, medial and the post-dorsal consonants in the frequency of occurrence in the word in Lucknow Urdu.
Section B3: Summary Statements

We present a brief summary on the various aspects and effect of the hierarchy of adroitness of the articulators below:

1. Apex lies at the top of the hierarchy of adroitness among all the lingual articulators. Below the apex lies the dorsum, followed by the medium and finally the post dorsum (root of the tongue). This difference in the adroitness of the various tongue parts is mainly due to the difference in their mass and musculature.

2. The impact of the hierarchy of adroitness of articulators can be seen in the production and usage of the consonants at apertures $\emptyset$ through 3. It is the result of the high adroitness of the apex that the apical consonants outnumbered the non-apical consonants, both in their paradigmatic makeup and their syntagmatic distribution. The apicals outnumbered the dorsal, medial and labial consonants when analysed through frequency counts in the form of statistical tables.

3. The comparatively less frequent use of the labials and dorsals and the least frequent use of the medials against the most frequent use of the apicals in the
monosyllabic words are presented in the form of tabular frequencies for stops, fricatives, liquid and nasals. In each case we conclude that the physiologically based hierarchy of the adroitness of articulators play a significant role in the makeup and distribution of the phonological units in Lucknow Urdu.

Section C: Impact of the Amount of Energy Utilized on the Combination of Units.

In this section, we will make an attempt to show as to how the amount of energy utilized by the apertures affect the combination of units of Lucknow Urdu.

In Section C(a), we will deal with the CVC, CVCC and CCVC combinations to see the impact of the amount of energy utilized on them. In Section C(b) and section C(c), we deal with the initial clusters and aspiration respectively, to highlight the effect of the amount of energy utilized on the combinatory phonology of Lucknow Urdu. In Section C(d) we present concluding remarks.

Section C(a): Effect of the Amount of Energy Utilized and the CVC, CVCC and CCVC combination of the Units

The frequency counts of the occurrence of the CVC, CVCC and CCVC combinations of the phonological units of Lucknow
Urdu are presented below in Table I(e).

<table>
<thead>
<tr>
<th></th>
<th>CVC</th>
<th>CVCC</th>
<th>CCVC</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>1669</td>
<td>101</td>
<td>8</td>
<td>1778</td>
</tr>
<tr>
<td>Percentage</td>
<td>93.87</td>
<td>5.68</td>
<td>0.45</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table I(e): Frequency of Occurrence of the CVC combinations versus CVC and CCVC combinations

Comments on the Table:

1. Here we present the CVC, CVCC, and CCVC words for frequency count in totality.

2. It is to be mentioned that different apertures (Ø through most open) require different amounts of energy for the production of the phonological units. Aperture-1 requires the greatest amount of energy to allow the passage of air through the narrowing of the vocal tract. Aperture 1, 1/2, and 2 require a little less amount of energy as compared to aperture-1. As for the apertures Ø and 3, the units articulated at these apertures are easier to articulate. From aperture-3 onwards there is a further decrease in the amount of
energy required for the articulation of the phonological units at these apertures. There is a gradual decrease in the amount of energy utilized for the articulation of the phonological units with the rise of apertures. The combinations of units articulated with lesser amount of energy are to be preferred over those that are produced by the utilization of greater amount of energy. Thus we can say that, the combinations that husband (conserve) the source of energy are preferred to those that dissipate (waste) it.

3. A cursory glance at the table conforms to our expectations. Of a total of 1778 monosyllabic words in Lucknow Urdu, we find 1669 (93.87%) of the CVC combinations as opposed to a handful of 101 (5.68%) combinations of CVCC words and only 8 (0.45%) combinations of CCVC words. Thus we can say that the CVC combinations are preferred over the CVCC and CCVC combinations in their usage in the word.

4. It is to be noted here that, the increased frequency of the CVC combinations show that units articulated at apertures-∅,1, 1, 1/2, 2 or 3 prefer to combine with higher apertures. This is due to the fact that the units articulated at higher apertures require lesser
amount of energy in their articulation. Thus, we can say that the combinations that conserve the energy are preferred over those that dissipate it.

5. It is to be pointed out here, that the CVC combinations are also preferred over the consonant clusters in terms of human behaviour orientation (cf. Chapter II, Section-D).

Section C(b): Effect of the Amount of Energy Utilized and the Initial Clusters

In this section we make an attempt to show that the combinations of initial clusters that conserve the source of energy are preferred over those that dissipate it. The actual occurrences of initial clusters in the CCVC of Lucknow Urdu are presented in Table- I:1(f) below:

<table>
<thead>
<tr>
<th></th>
<th>Stops</th>
<th>Nasals</th>
<th>Fricatives</th>
<th>Liquids</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No/%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>7/87.5</td>
<td>7/87.5</td>
</tr>
<tr>
<td>Nasals</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Fricatives</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1/12.5</td>
<td>1/12.5</td>
</tr>
<tr>
<td>Liquids</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>8/100</td>
<td>8/100</td>
</tr>
</tbody>
</table>

Table-I:1(f): Frequency of Occurrence of the Initial Consonants Clusters.
Comments on the Table:

1. The actual frequency of occurrence of the initial consonant clusters are presented in the table above.

2. Sixteen combinations of consonant clusters like stop \((\emptyset)+(\emptyset)\), stop \((\emptyset)+\text{fricative}(1)\) etc. are taken up for the word initial clusters.

3. It has already been mentioned in the previous section that, the amount of energy utilized for the production of the phonological units vary. Some utilize more energy and some less. The units of aperture-1 require the greatest amount of energy, followed by the units of apertures. 1 1/2, 2, \(\emptyset\) and 3. With the rise of aperture, there is a gradual decrease in the amount of energy required for the articulation of the phonological units. As a result, units utilizing lesser amount of energy are to be preferred over those that utilize a greater amount of energy.

4. The figures in the table presented above conforms to our expectations. Of a total of 9 instances of initial consonant clusters, 7 (87.5\%) combinations are of stop + liquid \((\emptyset+3)\) and only 1 (12.5\%) combination is of the type fricative + liquid \((2+3)\). There is a vast skewing in favour of such combinations that conserve the source
of energy as against those that require a greater amount of energy in Lucknow Urdu in the initial cluster words.

Section C(c): Effect of the Amount of Energy Utilized and Aspiration.

Here, we will see the effect of the amount of energy utilized on the aspiration of the units and also on the frequency of occurrence. We discuss this in the two sub-sections to follow. In Section C(ci) we analyze the monosyllabic words which have undergone deaspiration in the word final position. In Section C(cii) we discuss aspiration and voicing in the CVC words to show the impact of the amount of energy utilized in their frequency of usage in the word.


Here, we take up two types of aspirated monosyllabic words which have been deaspirated in the final position of the word in the subsections to follow.

(a) Monosyllabic Words with Initial Unaspirated Units.

The deaspiration in the word final position of the monosyllabic words in Lucknow Urdu is taken up here in terms
of the amount of energy utilized by them. A few examples of the deaspirated monosyllabic words are presented below*

<table>
<thead>
<tr>
<th>Classical Urdu</th>
<th>Lucknow Urdu</th>
<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>aːh</td>
<td>aː</td>
<td>sigh</td>
</tr>
<tr>
<td>uːbh</td>
<td>uːb</td>
<td>be fed up</td>
</tr>
<tr>
<td>pʊːch</td>
<td>pʊːc</td>
<td>tail</td>
</tr>
<tr>
<td>bʊdh</td>
<td>bʊd</td>
<td>Wednesday</td>
</tr>
<tr>
<td>baiʈh</td>
<td>baiʈ</td>
<td>seat oneself, sit down</td>
</tr>
</tbody>
</table>

*Ftn.: For a detailed list of deaspirated monosyllabic words see Chapter III, Section-D1.
Comments:

1. The deaspiration has taken place in the words presented above, in the word final position.

2. We have a physiological rationale for the deaspirated units here. Aspirated units which are based on h of aperture 1 1/2 and A of aperture 2, utilize a great deal of energy, similar to that of units at aperture-1. Units at aperture Ø require much energy for explosion and also does aperture 3. That is, the combination of aspiration (h and A) with the units of apertures Ø and 3 makes the combination highly energy consuming. Thus, aspirated units occurring in a syllable or a word require lots of energy and hence are physiologically disfavoured.

2. The disfavouring for the aspirated units in the final position of the word is also motivated through the communicative factor. It is seen that the word final position carries minimum communicative load (cf. Chapter-III Section-B3). Aspiration is also disfavoured in terms of utilizing an extra articulator (larynx) (cf. Chapter II, Section A2).
(b): **Monosyllabic Words with Both Initial and Final Aspirated Stops.**

In this subsection, we present the monosyllabic words of Lucknow Urdu, that are both initially and finally aspirated and in which deaspiration has taken place in the final position of the word. We list a few of such words of Lucknow Urdu below:

<table>
<thead>
<tr>
<th>Classical Urdu</th>
<th>Lucknow Urdu</th>
<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>bhiːkh</td>
<td>bhiːk</td>
<td>begging alms</td>
</tr>
<tr>
<td>jhuːṭh</td>
<td>jhuːṭ</td>
<td>lie</td>
</tr>
<tr>
<td>hāːṭh</td>
<td>hāːṭ</td>
<td>hand</td>
</tr>
</tbody>
</table>

**Comments:**

1. We see that in the above words deaspiration takes place finally.

2. It is to be noted here that aspiration has been retained in the initial position of the word. Thus, it is Grassman's Law in a reverse order being applied here, which signals a manifestation of physiology and communication.

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* Ftn.: For a detailed list of finally deaspirated words with initial aspiration or h see (Chapter II, Section-D2)
3. As mentioned earlier, the aspirated units which are a result of \( h \) at 1 1/2 aperture and \( A \) at aperture-2 require a great amount of energy which is very similar to that of units at aperture-1. Units of aperture-\( h \) due to their explosion and of aperture-3 also require much energy. Thus, a combination of aspiration \((h+A)\) and of the units at apertures \( h \) and 3 utilize a lot of energy. When two aspirated units occur in a syllable or in successive syllables, they require a lot of energy for their pronunciation. This makes the pronunciation difficult which is physiologically not suitable. So in terms of the amount of energy utilized, the occurrence of two aspirated stops in a syllable is highly disfavoured. Thus, the dropping of aspiration in the final position of word is justified in terms of the amount of energy utilized.

4. Grassman's law dictates the deaspiration of the initial aspirated stops. However, physiologically, the aspirated units are disfavoured in the final position and favoured in the initial position of the word. For the aspirated units we have to exhale the air which is coming from the lungs. We have more air available in the initial position of the word than in the final position of the word. Thus, in Lucknow Urdu, the final
aspirated units are deaspirated which is basically Grassman's law working in reverse.

5. The communicative factor also reinforces this deaspiration in the word final position because the final position of the word carries the minimum communicative load (cf. Chapter III, Section B3).

Section C(cii): Effect of the Amount of Energy Utilized on Aspiration and Voicing in the CVC Stops.

In this section, we make an attempt to highlight physiologically the complexity of aspiration over voicing in the light of the frequency of occurrence of the aspirated/unaspirated and voiced/voiceless stops in the initial and final positions of the CVC words. The actual occurrences have been presented in Table-I-1(g), below.

<table>
<thead>
<tr>
<th></th>
<th>Voiceless</th>
<th>Voiced</th>
<th>Total</th>
<th>Unaspirated</th>
<th>Aspirated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No/%</td>
<td>No/%</td>
<td>No/%</td>
<td>No/%</td>
<td>No/%</td>
</tr>
<tr>
<td>Initial</td>
<td>572/53.46</td>
<td>498/46.54</td>
<td>1070/100</td>
<td>724/67.66</td>
<td>346/32.34</td>
</tr>
<tr>
<td>Final</td>
<td>557/69.71</td>
<td>242/30.29</td>
<td>799/100</td>
<td>782/97.87</td>
<td>17/2.13</td>
</tr>
<tr>
<td>Total</td>
<td>1129/60.41</td>
<td>740/39.59</td>
<td>1869/100</td>
<td>1506/80.58</td>
<td>363/19.42</td>
</tr>
</tbody>
</table>

Table I-1(g): Frequency of Occurrence of Voiceless/Voiced and Unaspirated/Aspirated Stops in the CVC Words
Comments on the Table:

1. The frequencies of the unaspirated/aspirated and voiceless/voiced stops have been taken up here. The units are p ph b bh; t th d dh; ċ ḋ ḍ dh; c ch j jh; k kh g gh.

2. The aspirated and voiced stops involve an extra articulator, the larynx, in their production in comparison to their unaspirated and voiceless counterparts respectively. Thus, the aspirated and voiced stops are to be disfavoured over their unaspirated and voiceless counterparts in the use of an extra articulator which is a manifestation of the human behaviour orientation (cf. Chapter II, Section-A).

3. In terms of communication, we expect that the aspirated and voiced stops will be competing well with their unaspirated and voiceless stops in the initial position of the word which carries maximum communicative load (cf. Chapter III, Section B3).

4. It is to be noted that physiologically, the aspirated stops are more complex than the voiced stops. For, in the production of the voiced stops, the vocal folds vibrate, which does not require much energy. However, on the other hand, in the production of the aspirated stops, we require a puff of breath which is expelled from the lungs through the larynx. This process
involves extra energy. Moreover, aspirated stops are formed at aperture $\emptyset$ combining with h of aperture 1 1/2 and A of aperture-2) which require a great deal of energy. This make it physiologically disfavoured in terms of the amount of energy utilized in their production.

5. A cursory glance at the table conforms to our expectations. Of a total of 1070 occurrences initially 724 (67.66%) are unaspirated and 572 (53.46%) are voiceless. On the other hand, 346 (32.345) are aspirated and 498 (46.54%) are voiced occurrences in the initial position of the word. Of a total of 799 final stops, we find 782 (97.87%) of unaspirated stops and 557 (69.71%) of voiceless stops. In contrast to these figures, we have only 17 (2.13%) aspirated stops and 242 (30.29%) voiced stops in the final position of the word.

The above statistics clearly indicate the disfavouring for the aspirated and voiced stops over the unaspirated and voiceless stop, respectively. It is to be noted that aspiration having 32.34% occurrences in the initial position and only 2.13% in the final position as compared to voicing which has 46.54% occurrences initially and 30.29%, finally, is further
disfavoured in terms of voicing in the word final position.

Section C(d): Concluding Remarks:
1. Among the CVC, CCVC and CVCC words, combinations which require the least amount of energy are preferred over those that utilize a large amount of energy.
2. In initial clusters also, such combinations are preferred that conserve the source of energy rather than waste it.
3. It has been also seen that in the monosyllabic words of Lucknow Urdu, deaspiration has occurred finally in a large number of words. This is basically because of the increased amount of energy required for aspiration which is physiologically difficult, and is also supported by the communicative and human behaviour factors.
4. The figures analyzed for the initial and final positions of the unaspirated/aspirated and voiceless/voiced stops, show a clear disfavouring for aspiration over other features. This is because, features like aspiration involve some amount of complexity in that they are difficult to produce, both physiologically and in terms of the use of an extra articulator (larynx) (cf. Chapter II, Section A). This
disfavouring is increased in the word final position because of low communicative load and the lesser need to keep distinctions apart in terms of the communicative factor.

Section D: Summary and Conclusions

In this chapter we make an attempt to briefly present the physiological base of Lucknow Urdu in terms of physiological mechanism, an orienting principle of Form-Content Linguistics. We begin this chapter with the paradigmatic aspect, whereby, we present the phonological grid of Lucknow Urdu. In this, we present systematically the phonological units of Lucknow Urdu. Both the paradigmatic and the syntagmatic aspects probe the effect of the hierarchy of the adroitness of articulators on the making and distribution of the consonantal units respectively. We also analyze the impact of the amount of energy utilized on the combinatory phonology of Lucknow Urdu.

In Section-A, the phonological grid of Lucknow Urdu has been presented accompanied by relevant comments on the grid in the various sub-sections. It has been seen that the communicatively based phonological units are placed on the basis of their physiological substance on the relevant
physiological axes of articulators and apertures in the phonological grid.

We have postulated 61 phonological units for Lucknow Urdu which include both consonantal and vocalic (monophthongs and diphthongs) units. A systematic representation is given in Section A1, where we have comprehensively presented the phonological grid of Lucknow Urdu. In Section A2, we have made an attempt to explain the phonological grid of Lucknow Urdu in terms of its physiological features under different headings like mechanics of diagramming, constriction versus opening, consonants versus vowels etc. We have also highlighted the fact that although the phonological grid comprising of the phonological units, and the "phonemic inventory" consisting of the "phonemes", appear to be similar in their makeup, they do show some diversity from each other. It is to be noted, that the "phonemic inventory" of the language lists only the phonemes of that language. While on the other hand, the phonological grid of Lucknow Urdu lists all the phonological units which also include the "allophones" of that language "Allophones" that fall on the intersection of the relevant axes are raised to the status of phonological units. This is because the phonological units are tied with one another in terms of value relationships. It is to be noted that all intersections yielded by the articulators and
apertures are not filled. There are holes or gaps in the
pattern which shows that there is a departure from
randomness in the arrangement of the phonological units in
the grid of Lucknow Urdu.

We have shown three abstract phonological units in our
grid for Lucknow Urdu. They are N(asality), V(oicing) and
A(spiration) which do not occur as independent phonological
units, but are superimposed on the already established units
of Lucknow Urdu. They provide nasality, voicing and
aspiration to the respective phonological units where they
are required.

The phonological units of Lucknow Urdu can also be
broadly divided into consonants (apertures 0 through 3) and
vowels (aperture 4 through 8). This broad division also has
some physiological justification. The phonological units
established at apertures 0 through 3 (the consonants,
including liquids and nasals) are all characterized by
turbulence. In contrast, the phonological units formed at
apertures 4 through 8 (the vocalic units, both monophthongs
and diphthongs), are produced without any physiological
hinderance.

The effect of the hierarchy of the adroitness of
articulators on their paradigmatic makeup and syntagmatic usage in the word is discussed in Section B.

Keeping in mind, the hierarchy of the adroitness of articulators, we expect the apical consonants to be most preferred, followed by the more preferred labial dorsal consonants, the low preferred medial consonants and the least preferred post dorsal consonants, in this order, both paradigmatically and syntagmatically.

In Section B1, we make an attempt to assess and validate our claim of this hierarchy on the number of the phonological units in the paradigm of Lucknow Urdu.

In Section B2, we analyze the effect of the hierarchy of the adroitness of articulators on the frequency of occurrence of the consonantal units in the word. We have provided statistical figures to validate our claim that the effect of this hierarchy favours the apicals, followed by the labial-dorsal, the medial and the post dorsal consonantal units in descending order in their usage in the word in Lucknow Urdu.

Apart from assessing the effect of this hierarchy on the consonantal units in their entirety, we have also separately dealt with the monosyllabic stops, fricatives, liquids and
nasals in individual subsections, supported by statistical data.

In Section C, we make an attempt to show how the amount of energy utilized by the various phonological units at different apertures, affect their usage in the word.

In Section C(a) we see that as a result of lesser utilization of energy by the CVC words, as compared to the CVCC and CCVC words, the frequency of occurrence is much higher for the CVC words as opposed to the cluster words. In other sections it is also seen, that in Lucknow Urdu, for the initial clusters in the monosyllabic words, only such combinations are preferred which husband the source of energy rather than dissipate or waste it. It is also seen that aspiration, which requires a great amount of energy, is also avoided mostly in the word final position, both in cases where the words begin with or without aspirated units. Besides, physiological factors, there are other factors like human behaviour and communication which support it.

To conclude we can say that the physiological factors play a role in determining the phonological units of a language. It is however communication, through which these units are established. The physiology of the vocal tract affects the makeup and distribution of the phonological units in Lucknow Urdu.
We however, also encounter certain skewings which do not totally conform to our expected results in terms of the hierarchy of the adroitness of the articulators. We have provided proper rationales to explain these skewings wherever possible.