CHAPTER I

ROLE OF PHYSIOLOGICAL MECHANISM IN THE MAKE-UP AND DISTRIBUTION OF PHONOLOGICAL UNITS IN DELHI URDU.

As we have discussed in the theoretical background (Introduction), the phonological analysis of Delhi Urdu presented in this work deals with the explanation of the non-random make-up and distribution of phonological units on the basis of five orienting principles (physiological mechanism, acoustic medium, communication, human behavior, and vision) of Columbia School of Linguistics. In this chapter, we take up the phonological analysis of Delhi Urdu in terms of only one of these orientations, namely, the physiology of the vocal tract or the physiological mechanism.

Phonological analysis of Delhi Urdu in terms of physiology is presented in five sections. Section A deals with the physiological make-up of phonological units, the phonological grid, in terms of two physiological variables, namely, articulators and apertures. In section B, we study the impact of the distribution of air stream on the combination of phonological units in Delhi Urdu. Section C, deals with the hierarchy of adroitness of and its effect on the make-up and distribution of consonants in Delhi Urdu. In section D, we discuss the physiological importance of the greater mass of the tongue (medium-dorsum) in the production of vowels. In section E, we present Summary and Conclusions with regard to the impact of physiological mechanism on the phonology of Delhi Urdu.
Section A. Phonological Gird of Delhi Urdu

The units of the phonological system of Delhi Urdu are produced by eight (8) articulators in combination with ten (10) apertures. The articulators are the labium (lower lip), the apex, the medium, the front dorsum, the back dorsum, the post dorsum, the velum, and the glottis. The degrees of apertures are 0, 1, 1½, 2, 3, 4, 5, 6, 7, and 8. It may however be emphasized that the articulators and the apertures do not randomly produce phonological units at all their intersections. Of eighty (80) potential intersections, only fifty seven (57) are actually filled by phonological units in Delhi Urdu. It is noteworthy that these 57 units include both the "dental" consonants and the "retroflex" consonants, produced at two axes of a single articulator, the apex. Cf. section A2 (9) below.

The network of the aforesaid 57 phonological units, based on the articulators and the aperture, is termed the phonological grid of Delhi Urdu.

It may be noted that the phonological units of a language are not established by physiological mechanism alone. Of the 57 phonological units, fifty three (53) units, traditionally known as the phonemes, are primarily determined by contrast through minimal and sub-minimal pairs, a criterion based on the communicative principle. However, once the phonemes are determined, they are classified in terms of their physiological make-up in the phonological grid.

The phonological grid of Delhi Urdu is presented in section A1. A discussion on the grid through comments follows in section A2. In section A3, we have a summary statement on the phonological grid.
Section A.1. Presentation of the Phonological Grid.

On the basis of physiological mechanism (supported by other orienting principles), we have established 57 phonological units for Delhi Urdu. Following the traditional terminology, we may classify these units into forty one (41) consonants (21 stops, 5 nasals, 9 fricatives, 6 liquids), and 16 vowels (8 oral, 8 nasal; 6 short, 10 long). All these phonological units are systematically presented in the phonological grid in Diagram I-1.

Section A.2. Comments on the Phonological Grid.

The comments, both descriptive and explanatory, on the various physiological aspects of the phonological grid, are presented below:

(1) : Mechanics of Diagramming.

The Delhi Urdu phonological grid (Diagram I-1) has been drawn in such a way that it successfully highlights the physiological characteristics of the phonological units of this dialect of Urdu.

Here the phonological units are classified vertically in terms of articulators and horizontally in terms of degrees of aperture. Dash dotted lines show the division between constriction and opening of the apertures in terms of their physiological characteristics.

Letters, both lower-case and capital used in the diagram, represent Delhi Urdu. It may be noted that V.A. and N are abstract units of voicing, Aspiration, and Nasality respectively.
<table>
<thead>
<tr>
<th>Articulators</th>
<th>Apertures</th>
<th>Labium</th>
<th>Apex</th>
<th>Apex</th>
<th>Medium Front</th>
<th>Back</th>
<th>Post</th>
<th>Velum</th>
<th>Glottis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Diagram 1: Phonological grid of Delhi Urdu
The solid lines connecting the various phonological units in the diagram, show the interrelationships between the phonological units, whereas the solid line with arrow indicated the voicing (coming from V on aperture-1 at glottis). The broken lines with arrow indicate the voiced aspirated units of the system (voiced aspiration comes from h on aperture 1 1/2 at the glottis). The double broken lines with arrow indicate the aspirated units without voicing (voiceless aspiration comes from A of aperture 2 at the glottis). Dotted lines with arrow connect nasal consonants and N on the one hand, and the nasalized vowels and N on the other.

Arrow with Apex-dentum and apex-palatum, indicates that apex is the articulator with the teeth and hard palate as the respective points of articulation. The forks in the diagram at aperture-3 signify that though the forked phonological units are at the intersection of the same articulator and the same aperture, they are to be distinguished from each other in terms of their physiological make-up.

(2) : Constriction versus Opening.

As pointed out in the mechanics of diagramming above, the apertures can be divided into two basic categories, namely constriction and opening, in view of their differing physiological characteristics. The apertures known as constriction (0 through 2) are the smaller apertures, whereas the apertures known as opening (3 through 8) are large apertures.

The phonological units formed at constriction (0 through 2) are characterized by the noise activated by the close contact of the articulator and point of articulation. In contrast, the units that materialize at the
apertures of opening (3 through 8) are marked by resonance; there being no close contact or stoppage.

For the apertures of constriction, the contact between the articulator and the associative point of articulation is so close and the distance between the degrees of aperture is so narrow that they can be measured in absolute terms.

Inasmuch as the pertinent supraglottal articulator, in combination with the apertures of constriction can both shape and excite the vocal cavity in the production of phonological units at these small apertures, there is no obligatory, physiological, requirement to utilize an extra articulator, such as larynx, for the production of these units. Thus, voicelessness becomes the simplest phenomenon in the production of consonants at apertures of constriction. To be sure, the phonological units with both voicing and aspiration are formed at the constriction apertures. But these units are physiologically more complex, as they require the use of larynx as an extra articulator.

In contradistinction to the small and absolutely defined apertures of constriction, the apertures of opening are large, and their position vis-a-vis each other, can only be defined in relative terms.

As the local supraglottal articulator, in combination with the apertures of opening cannot excite the cavity in the production of speech sounds at the larger apertures, the excitation is brought about by introducing the vibration of the glottis and the local articulator merely shapes the cavity. It is possible to excite the cavity at these larger openings without
the vibration of the glottis; but this requires a great expenditure of the air supply.

Thus, while maintaining the classical distinction of vowels and consonants, we have tried to provide a physiological rationale for this distinction.

(3) : **Phonemes versus Phonological Units.**

Phonemes are presented in the phonemic inventory for demonstrating neatness of pattern and economy in their number. The phonemes are arrived at by following the discovery procedures. Theoretically they are established through distribution substitutional criterion. However a short cut is resorted to by establishing them through minimal pairs, using meaning distinctions. In practice therefore phonemes are established in terms of meaning although this word is considered as taboo in traditional phonemics. The phonological units of a grid contain all the phonemes that are established through minimal pairs by using meaning distinctions. But this is done without any apology with regard to meaning. For communication is a full-fledged orienting principal of form-content phonology. Communication also plays a role in the make-up of the phonological grid. (Cf. chap.III. section A).

Phonological units differ from phonemes in another and more important aspect. The phonological units set up through communicative distinctions, are formally classified in terms of articulators and apertures. We have therefore a network of horizontal and vertical axes, crossing phoneme type phonological units. As it is to be expected, not every intersection
of the vertical and horizontal axes is filled by these units. For there is reason to have symmetry in the phonological units, which are produced by a asymmetrical vocal tract. At the same time, those allophones of the phonemes that fall on the intersections of articulators and apertures, are raised to the status of phonological units. Thus, phonological units comprise all the phonemes plus some positional variants falling on the intersections of relevant axes.

The above distinction between phonemes and phonological units may be illustrated through the apico-palatal and medial nasals (n n) in Delhi Urdu. Medial and apico-palatal nasals are elevated to the status of phonological units, because they fall on the intersection of the relevant articulators and aperture. The two above mentioned nasals can be regarded as all-ophones of phoneme and according to the analysis in terms of phoneme principle.

(4) : The status of V,A and N as Phonological Units

The status of V,A and N as phonological units of Delhi Urdu as shown in Diagram is some what different from that of all other phonological units. Unlike other units, V,A and N do not stand for particular speech sound in Delhi Urdu. Instead, they represent V(oeicing), A(spiration) and N(asality) respectively.

Although, all phonological units are abstractions, the V,A, and N represent a higher degree of abstraction than the other units in the phonological grid.
The make-up of V, A, and N is taken up one by one below:

(i) V(oiing) : This phonological unit fall on the intersection of the axis of glottis vertically and that of aperture-1 horizontally. In the articulation of all voiced phonological units, the glottis opens to aperture-1 in such a way that the air forcing its way through the resulting slit becomes turbulent. This turbulence force the vocal cords to vibrates, thus producing the hum called v(oiing).

All the supraglottal phonological units of aperture 3 through 8 are produced in combination with v(oiing). The v(oiing) also combines with the relevant supraglottal articulator at aperture 0, 1 and 2 to produce voiced stops and nasal and voiced fricatives in Delhi Urdu. This link of v(oiing) with the voiced phonological units in Delhi Urdu is appropriately shown in the grid (Cf. Diagram I-1).

(ii) A(spiration) : This phonological unit falls at the intersection of glottis and aperture-2. As compared to V(oiing), A(spiration) requires comparatively less constriction at the glottis. However, the glottis constriction at aperture-2 remains sufficiently narrow to produce h-aspiration

The supraglottal voiceless aspirated stops at aperture-0 are produced in combination with the A(spiration) in Delhi Urdu. This link of A(spiration) with the voiceless aspirated phonological grid of Delhi Urdu (Cf. Diagram I-1).
(iii) N(asality) : This phonological unit falls at the intersection of the articulator velum and the aperture-3. The N(asality) is produced by lowering the velum sufficiently enough, to open the nasal cavity to aperture-3. Due to this lowering of velum, air stream to pass through the nasal cavity as well as through the oral cavity.

All the nasal consonants and the nasalized vowels of Delhi Urdu are produced in combination with N(asality).

The N(asality) at aperture-3 combines with the relevant articulators at aperture-0 to produce the nasal consonants. The nasalized vowels of Delhi Urdu are produced by the medium, front dorsum and back dorsum at apertures-4 through 8, again in combination with N(asality). The link of N(asality) with both the nasal consonants and nasalized vowels is properly indicated in Diagram I-1.

(5) : Labio-dorsal Phonological Units: Units formed with two Articulators.

In the make-up of some phonological units in Delhi Urdu, the articulator labium combines with the articulator back dorsum at the apertures of opening (3 through 7) that is, the phonological units, such as the semi-vowel w and the vowels u:, u:, o:, o: etc., placed in the column of back dorsum in the grid (Diagram I-1), are simultaneously produced by two articulators: Back dorsum and Labium. That labium is employed as an additional articulator for the back dorsal vowels and the semi-vowel w, is not accidental. The acoustic rationle for the simultaneous use of the two articulators will be provided, when we take-up the next chapter.
(6) : Units at two points of Articulation with the same Articulator.

The apico-dental and the apico-palatal phonological units as presented in the phonological grid of Delhi Urdu (Diagram I-1) are the units produced by a single articulator, namely, the apex, in contact with different points of articulation, that is, the 'teeth' and the 'palate' respectively. The Apex-teeth and the Apex-palate are recognized as relevant vertical axes, solely becomes most of the phonological units (particularly the stops) produced at the two points of articulation, are characterized by distinctiveness and recognized as opposing phonemes.

The distinction between the apico-dental and the apico-palatal units is traditionally recognized as the distinction between the dental and the 'retroflex' consonants (Cf. chapter III, Diagram III-1).

(7) : Phonetic Variants at two Points of Articulation with the Same Articulator.

The phonological units on the vertical axis of labium are all produced by a single articulator, namely, the lower lip. However, while the point of articulation for p, ph, b, bh, m, and w is the upper lip, the fricatives f and v are produced with the edges of the upper teeth as point of articulation. Despite the two different points of articulation for the labial consonants, we have not set two different series of bilabials and labio-dentals, for lack of contrast between the two categories on a single aperture. Labium + contact is found on 0 and 3 apertures while labium + dentum contact is found on aperture-1 only.
In Delhi Urdu, phonological grid (Diagram 1-1) we observe that both the labio-dental fricative f and v and the bilabial stops and nasals (p, b, m, etc) have been placed under the articulator, labium. Thus, the phonological units under labium have two points of articulation, namely, the upper lip and lower edges of upper teeth. This placement of units with two points of articulation on a single axis, is justified for several reasons: firstly, we are classifying the phonological units of Delhi Urdu in terms of the various articulators. The unit f and v, and the other units in the labial column are produced by the single articulator, the lower lip. Secondly, there is no labio-dental axis in opposition to the bilabial one in Delhi Urdu. In the previous section, we set up two separate axes, apico-dental versus apico-palatal with one articulator and two points of articulation, only because the phonological units on the two axes were in contrast with each other. But this is not the case with the labio-dental and the bilabial consonants dealt with here, for we do not have a bilabial fricative 0 in Delhi Urdu in opposition to the labio-dental fricative f. Thirdly, the lower edges of the upper teeth are ideal target for the fricatives at aperture-1, while the upper lip, as point of articulation, provides an air-tight closure for the stops (and nasals) at 0-aperture. The perforated surface of the upper teeth is most suited to serve as point of articulation for the fricatives, where friction is required. Thus, we have a physiological rationale for the phonological units f and v to be labio-dental. It is noteworthy that when the IE labial stop becomes labio-dental f in Germanic through the intermediary stage of o.
The Production of the Voiced-h

Urdu language and all its dialects are characterized in having a voiced-h and the voiced aspirates. The Delhi Urdu, voiced aspirated stops (bh dh dh jh gh) are all produced in combination with the voiced-h.

The voiced-h is highly complex in that it is produced by an unusual maneuvering of the vocal folds at aperture one and a half (1 1/2). (cf. Introduction, section C.)

The V(oice) is produced by the vocal folds in parallel position, forming a narrow slit at aperture 1. However, the vocal folds form a triangular configuration in the production of the voiceless A(spiration) or the voiceless-h at aperture 2. This triangular configuration for the vocal folds is not unusual in that it is also utilized by human beings in respiration.

In contradistinction to the above two configurations, the vocal folds form an unusual triangular configuration, wherein the area of the triangle is exactly half of that utilized in producing the voiceless A(spiration). It is in this sense that the voiced-h is produced at aperture one and a half (1 1/2). Inasmuch as this particular configuration is not utilized normally by human beings, the vocal folds have to do a subtle maneuvering to take up this configuration to produce the voiced-h. It is this intricate maneuvering of the vocal folds that makes the voiced-h a highly complex speech sound. That is why the voiced-h and the voiced aspirates are rarely used as phonological units and are mainly confined to Indo-Aryan Languages including Urdu.
(9) : Apico-dental versus Apico-alveolar

Some of the phonological units at the apex-dentum axis also show a variation in the points of articulation. The points of articulation for the units l, v, n, range from upper teeth to alveolar ridge. These units are clearly apico-dental when they occur before the apico-dental stops Elsewhere, these units are produced at the alveolar ridge as their point of articulation, alveolar. Inasmuch as, we do not have distinction between the apico-dental and apico-alveolar consonants we set up only one axis, that of apex-teeth, for Delhi Urdu.

(10) : The substance and Value of the Phonological Units :

The phonological units presented in the grid are characterized by their specific phonetic substance, which can be identified in terms of physiological mechanism or experimentally measured in terms of acoustic medium. At the same time the phonological units also enter into interrelationship with one another in the entire paradigm. That is, these units are also characterized by the value relationship. Thus, equal weightage is given to substance and value of the phonological units presented in the grid of Delhi Urdu.
Section A: Summary Statement

1. In section A we have dealt with the postulation of the phonological units of Delhi Urdu in terms of two physiological variables, namely articulator and apertures.

2. Phonological grid (Diagram 1-1) is mainly a network of horizontal and vertical lines. Horizontal lines represent aperture, while vertical lines represent articulator, eight articulator combine with nine degrees of aperture in the formation of phonological units of Delhi Urdu.

3. One of the articulator, namely, apex forms two separate axes with two different points of articulation. Furthermore apex has two pronged units at the two points of articulation at aperture 3.

4. Some of the phonological units (nasals and h.) are formed by combining two apertures.

5. The phonological units presented in the grid are characterized by their specific phonetic substance, which can be identified in terms of physiological mechanism. At the same time, the phonological units also enter into interrelationship with one another in the entire paradigm, that is these units are also characterized by the value relationship.

6. Phonological grid differs from phonemic inventory, unlike phonemic inventory, the phonological grid is organized in terms of articulators and aperture. Furthermore, the so called 'positional variants' are also elevated to the status of phonological units if they fall on
the intersection of relevant articulators and apertures.

7. Degrees of apertures for Delhi Urdu are subjected to two broad divisions. The first one divides the apertures into absolutely defined constriction apertures (0 - 3) and relatively large apertures without constriction. The second division draws a line between resonants (3 - 8) and non-resonants (0 - 2).
Section B: Impact of the Distribution of Air stream on the Combination of Phonological Units in Delhi Urdu

As we know articulators modity air pressure by moving to various points and directions. Phonological units vary in the number of articulators involved and apertures. Source of all sound production is flowing current of air stream, discharged from the lungs. Articulatory movements transform air into sounds we hear. Phonological units consume varying quantities of air source, which is released through a very restricted channel consume greater air source. So releasing greater amount of air source necessiating a use of greater air supply.

The impact of the distribution of the air stream on the combination of phonological units will be assessed in three subsections below. Section B\textsubscript{1} deals with the combination of two aspirated consonants in the monosyllabic words in Delhi Urdu. In section B\textsubscript{2} we take up skewings caused, by the strenous release of the units. Section B\textsubscript{3} concluding remarks on the impact of the distribution of air stream on the combination of phonological units.

Section B\textsubscript{1}: Phonological Units that use the Greater Amount of Air Source are not likely to be repeated in a Row

Aspiration is streneous expulsion of 'air puffs' just beforoe the vowel. The puffs require greater amount of air, Physiologically, aspiration is the action of glottis at aperture 1\frac{1}{2}. In all cases of aspiration glottis sets to accommodate to get greater air supply, it expands to greater degree and with sudden blow emitts the air build up the force of exhalation is
so great that we can feel a paper shaking badly if we keep it before the mouth at the time of the release of the aspirated units. Thus, aspirated units when once exited are less likely to be repeated again in succession, because aspirated units use greater amount of air pressure. The lungs get 'emptier' after the production of an aspirated unit so repetition is physiologically less possible. In Classical Greek and Sanskrit too, this tendency was discovered. (Grassman's Law), where for two aspirated sounds of PIE only one is found (medial one). The effect of consumption of greater amount of air source is established by comparing the repetition for voiceless-voiced stops (unaspirated) and those of unaspirated-aspirated stops in the initial and final position of the word. The repetitions are presented below in the subsections. In Section B₁ (a) number of repetition for voiceless and voiced (unaspirated) stops in the initial and final position of the word is presented, while section B₁ (b) contains repetition for unaspirated and aspirated consonants in the initial and final position of the word.

Section B₁ (a) : Repetition of Voiceless and Voiced Stops (Unaspirated) in the Initial and Final Position of the Word

Number of words for repetition of voiceless unaspirated and voiced unaspirated stops in varying combination is presented in Table I-1.

Table I - 1 : Repetition of voice

<table>
<thead>
<tr>
<th>Combination</th>
<th>Initial</th>
<th>Final</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Voiceless</td>
<td>Voiceless</td>
<td>168</td>
</tr>
<tr>
<td>2.</td>
<td>Voiced</td>
<td>Voiceless</td>
<td>110</td>
</tr>
<tr>
<td>3.</td>
<td>Voiced</td>
<td>Voiced</td>
<td>89</td>
</tr>
<tr>
<td>4.</td>
<td>Voiced</td>
<td>Voiceless</td>
<td>28</td>
</tr>
</tbody>
</table>
Comments on Table I - I:

1. The number of words for the combination of initial voiceless unaspirated stops and final voiceless unaspirated stops is 168. The number of words for recurrence of voiceless unaspirated stops is 110. The number of words for initial and final voiced unaspirated stops is 110. The number of words for initial and final voiced unaspirated stops is 89. The number of repetition for voiced unaspirated and voiceless unaspirated in the initial and final position of the word is 28.

2. Number of words clearly tell us that for unaspirated stops repetition takes place in all combinations (for the relative disfavoring of voiced stops, cf. chapter III section B).
Comments on Table I - 2:

1. The number of words for the combination of unaspirated stops in the initial and final position of the word is 393. The number of repetition for combination of aspirated and unaspirated stops is 160. The number of repetitions for initial unaspirated, final aspirated and number of repetition for initial and final aspirated stops both are zero.

2. The absence of combination of final aspirated and stops is of course due to the physiological fact that aspirated units take much air, and less air is left for another aspirated unit after an initial aspirated unit. In Delhi Urdu the final aspiration is totally eliminated.

Section B2: Impact of such Combination that Conserve the Source of Energy are Preffered to those that Dissipate it.

The manipulation of articulators to various degrees along the running continuum of air pressure produce apertures. Manipulation of articulators to various apertures is not the same, that is aperture vary in the precision of control required by the articulator to release the air source.

Phonological units that do not involve any restriction of air flow, carry lesser consumption of air supply. On the other hand phonological units produced with the restriction of air stream necessiates use of greater air source. As we know vowels involve no constriction these use lesser effort and air source. In contradistinction to vowels consonants involve restriction of air flow (to various degrees), demand greater precision of control by articulators and consequently consume greater source of energy,
which is naturally nothing but the air flow coming from the lungs. Among the consonants units of aperture 1 and 0 are the most difficult apertures. Aperture 1 involves releasing air stream through a very restricted channel, therefore it is the most difficult aperture for Delhi Urdu. In view of its complete stoppage, and explosive release aperture 0 is next in terms of difficulty, next come 2 and 3 in order of difficulty.

When phonological units vary in relative consumption of air source and difficulty, we are bound to get various skewings caused by the differences of air consumption in their production.

There will be abundance of the combination of units of constriction 'consonants' with opening vowels. We should therefore expect more CVC than CVCC or CCVC. Since the present analysis is limited to only monosyllabic words therefore we have excluded combinations of two units openings (VV). At this moment we can assume VV to be higher than CC(V) and (CV) CC. There should be clear favoring for CVC because a vowel after consonant brings respite from the tension of the precision of articulatory control and hence saves energy for the remaining utterance. Whereas two units of constriction will mean further increasing the difficulty. When a single unit is difficult to produce then its articulation twice is virtually a wastage of energy. Therefore, there should be more words of CVC structure and less CCVC or CVCC structure.

Our expectation that the combinations of units of constrictions with units of openings will occur in large number, is greatly met. The preference for combination of units of constriction with of units of opening is established by comparing the number of CVC, CCVC and CVCC words. The number and percentages of CVC, CCVC and CVCC words are given in Table I-3.
Table I - 3: CVC Words versus CCVC and CVCC Words

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVC</td>
<td>1674</td>
<td>92.30</td>
</tr>
<tr>
<td>CCVC</td>
<td>8</td>
<td>0.70</td>
</tr>
<tr>
<td>CVCC</td>
<td>72</td>
<td>7.00</td>
</tr>
<tr>
<td>Total</td>
<td>1754</td>
<td>100</td>
</tr>
</tbody>
</table>

Comments on Table I - 3:

1. When we look at the table it becomes clear to us that of the 1754 monosyllabic words in Delhi Urdu, 1674 (92.30%) are CVC words. CCVC words are 8 (0.70%) and CVCC words are 72 (7.00%).

2. The highest number and percentage of CVC words is certainly due to the fact that in successive segments combination of consonant with vowel is more frequent because to pronounce two consonants in succession requires greater precision of control, which in turn requires more energy (that is air source), therefore combinations comprising of two consonants in succession are less frequent in Delhi Urdu.

Section B3: Concluding Remarks

1. The source of all sound production is air pressure coming from the lungs.
2. Combination of phonological units that lead to greater expenditure of air source are less frequent in Delhi Urdu.

3. It is the greater use of air source that two aspirated consonants are not combined in succession in Delhi Urdu.

4. Combination of two consonants in succession is less frequent that the combination of one consonant and one vowel, because production of consonants is more difficult and requires greater air source than the production of vowels. As such CVC words are more frequent in the dialect as compared to CCVC and CVCC.
Section C: The Hierarchy of the Adroitness of Articulators: The Apex, Labium, Dorsum Medium and Post-Dorsum

As we have discussed in the introduction (theoretical background, Section C_{1} (aiii), the apex stands at the top of hierarchy of adroitness among the lingual articulators, next follows dorsum, medium and the post-dorsum (or the root) in that order. It is to be pointed out earlier that we have also made defectoplacement of labium on the scale of adroitness of lingual articulators. Given the musculature of the lower lip and the adroitness of the lower jaw, we can expect that labium would definitely be place below apex and above the medium and close to dorsum in terms of adroitness.

Given the physiological make-up and musculature of the apex, medium, dorsum and the post-dorsum the hierarchy of adroitness has great influence on the production of phonological units at apertures 0 through 3 (consonants) Phonological units of 0 to 3 apertures involve blocking and narrowing of the air passage at some point in the mouth of glottis and the mobility of articulators has great influence on their production. Because the adroitness of articulator facilitates the articulators in the excitation and shaping of the oral cavity. Given the greater adroitness of apex and the production of consonants we expect the maximum use of apex for consonants \textit{vis-a-vis} other articulators. Thus, in combination with 0-3 aperture, lingual articulators are preferred in order of the hierarchy of adroitness: apical, dorsal, medial and post-dorsal.

The effect of hierarchy of adroitness of articulators on the production of consonants of Delhi Urdu will be taken up in three subsections below.
In section C₁ we deal with the effect of hierarchy of adroitness on the number of phonological units, from 0 to 3 apertures (consonants). Section C₂ contains the proportionate occurrence of phonological units in terms of the hierarchy of adroitness of articulators for the consonants in the monosyllabic words of Delhi Urdu. And finally, in Section C₃ we present summary statement of the entire section C.

Section C₁: Effect of the Hierarchy of Adroitness of the Articulators on the Number of Phonological Units

As shown in the phonological grid (Diagram I-1), we find that the hierarchy of adroitness effects the number of phonological units. Apex being the adroit articulator, is used in the production of maximum number of phonological units, likewise, medium of the tongue being least adroit, is used in the production of least number of phonological units.

Here we will deal with the effect of hierarchy of adroitness of articulators on the number of phonological units is examined systematically in Diagram I-2.
## Diagram I - 2: Hierarchy of the Adroitness of Articulators and the Make-up of Consonantal Units

<table>
<thead>
<tr>
<th>Apertures Articulators</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teeth</td>
<td>td; th dh; n</td>
<td></td>
<td>sz</td>
<td>l r</td>
<td>9</td>
</tr>
<tr>
<td>Apex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16</td>
</tr>
<tr>
<td>Palate</td>
<td>td; th dh; n</td>
<td></td>
<td></td>
<td>(l) r</td>
<td>7</td>
</tr>
<tr>
<td>Lambium</td>
<td>pb; ph bh; m</td>
<td></td>
<td>fv</td>
<td></td>
<td>w 8</td>
</tr>
<tr>
<td>Dorsum</td>
<td>kg; kh gh; n</td>
<td></td>
<td>x g</td>
<td></td>
<td>w 8</td>
</tr>
<tr>
<td>Medium</td>
<td>cj; ch jh; n</td>
<td></td>
<td>s (z)</td>
<td></td>
<td>y 8</td>
</tr>
<tr>
<td>Post-Dorsum</td>
<td>q</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>G.T.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>41</td>
</tr>
</tbody>
</table>

Diagram I - 2 shows the hierarchy of the adroitness of articulators and the make-up of consonantal units.
A total of 16 consonantal units are produced by the highly adroit apex. This consist of 9 apico-dental and 7 apico-palatal units. The labium and the dorsum produce 8 units each (including the labio-dorsal liquid w), and the medium also produce 8 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.

As shown in the Diagram 1-2, there is a clear preference for apical consonants in Delhi Urdu. Unlike other articulators, apex forms two axes of consonants -- apico-dental and apico-palatal. As a matter of fact, the apical consonants are exactly double in number then the dorsal, labial, or medial consonants. Whereas we expect fewer medial consonants then dorsal or labial consonants, we actually encounter 8 units under each category. As the post-dorsum (root of the tongue) is the least adroit articulator.
Section C₂ : Effect of the Hierarchy of the Adroitness of the Articulators on the Frequency of Occurrence of the Consonantal Units

In this section, we will assess the impact of the hierarchy of the adroitness of articulators on the syntagmatic usage of the consonantal units in Delhi 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. This quantitative assessment is presented in six subsections below.

In Section C₂ (a), we examine the effect of the hierarchy of articulators on the consonantal units in their entirety. In Sections C₂ (b), C₂ (c), C₂ (d) and C₂ (e), we evaluate the impact of this hierarchy on the stops, 'fricatives', 'liquids' and 'nasals' respectively. In Section C₂ (f), we present concluding remarks with regard to the effect of the hierarchy of the articulators on the syntagmatic distribution of phonological units in Delhi Urdu.

Section C₂ (a) : Consonantal Units in Terms of the Articulators in the Hierarchy of Adroitness

In this section, we assess the effect of the hierarchy of the adroitness of articulators on the frequency of occurrence of all the consonants in Delhi Urdu. The relative frequency of the opposing consonantal units are presented in Table I-4.
<table>
<thead>
<tr>
<th>Consonantal Units</th>
<th>CVC words</th>
<th>CVCC words</th>
<th>CCVC words</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Aperture (0,1,2,3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Articulators</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apical-dental</td>
<td>1164</td>
<td>37.36</td>
<td>81</td>
<td>84.62</td>
</tr>
<tr>
<td>Apical-palatal</td>
<td>349</td>
<td>11.32</td>
<td>26</td>
<td>11.93</td>
</tr>
<tr>
<td>Apical</td>
<td>1513</td>
<td>49.08</td>
<td>107</td>
<td>49.09</td>
</tr>
<tr>
<td>Labial</td>
<td>628</td>
<td>20.37</td>
<td>34</td>
<td>15.60</td>
</tr>
<tr>
<td>Doral</td>
<td>523</td>
<td>16.96</td>
<td>59</td>
<td>27.06</td>
</tr>
<tr>
<td>Medial</td>
<td>406</td>
<td>13.17</td>
<td>17</td>
<td>7.80</td>
</tr>
<tr>
<td>Post-dorsal</td>
<td>13</td>
<td>0.42</td>
<td>1</td>
<td>0.45</td>
</tr>
<tr>
<td>Total</td>
<td>3083</td>
<td>100</td>
<td>218</td>
<td>100</td>
</tr>
<tr>
<td>G.T.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1 - 4: Frequency of occurrences of consonants units in the Monosyllabic Words in terms of Articulators
Comments on Table I - 4:

1. Of the 3323 consonants (stops, fricatives, liquids, nasals, are combined) used in the monosyllabic words, 1627 (48.96%) are apical, 667 (20.07%) labial, 584 (17.57%) dorsal, 431 (12.97%) medial and 14 (0.42%) post-dorsal. This distribution clearly conforms to our expectation in terms of the hierarchy of adroitness of articulators.

Although they fall far behind in the frequency of usage in comparison with the apical consonants, both the labial and the dorsal consonants compete well with each other in their usage in the word. This is perfectly justified in view of the fact that labium and dorsum occupy the same place on the scale of the adroitness of articulators.

As compared to the dorsal consonants the medium consonants are expectedly less frequent (431; 12.97%), for the medium is a less adroit lingual articulator than the dorsum. There is a drastic skewing against the post-dorsal consonants (14; 0.42%), in view of the fact that they are produced by the least adroit post-dorsum.

2. Among 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 3083 consonantal occurrences in these words, there are 1513 (49.08) occurrences of the apical consonants alone.
Whereas they are much less frequent than the apical consonants, the labial consonants 628 (20.37%) and the dorsal consonants 523 (16.96%) 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 406 (13.17%) goes down further followed by the post dorsal consonants 13 (10.42%), which is justified in that they are produced by the least adroit post dorsum.

3. Of a total of 218 CVCC words, the apical consonants, produced by the most adroit apex, account for more than half of the total frequency of occurrence 107 (49.09%).

The difference between the apical consonants and the labial consonants 34 (15.60%) and the dorsal consonants 17 (7.80%) conforms to our expectations regarding the hierarchy of articulators.

4. Amongst the CCVC words, we encounter a total of 7 apicals out of a total of 22 occurrences. The frequency of occurrences of the labial 5 (22.73%) and dorsal 2 (9.09%) 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 Delhi Urdu, the second member of the CCVC cluster is either the medial w or y which is to be found in words like; pyar 'love'; kya: 'what'; dwar '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 C.2 (b) : Stops in Terms of Articulators in the Hierarchy of Articulators: At 0 aperture

In this section, our comparison of the frequencies for the apical, labial, medial dorsal, and the post-dorsal units is restricted to only the stops. The actual occurrences of the opposing stops in monosyllabic words are presented in Table 1-5:
<table>
<thead>
<tr>
<th>Stops</th>
<th>CVC</th>
<th>CVCC</th>
<th>CCVC</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aperture (0) Articulators</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Apical-dental</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>31</td>
<td>31.96</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apico-palatal</td>
<td></td>
<td></td>
<td>280</td>
<td>14.94</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apical</td>
<td>618</td>
<td>32.98</td>
<td>48</td>
<td>49.49</td>
</tr>
<tr>
<td>Labial</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dorsal</td>
<td>445</td>
<td>23.74</td>
<td>21</td>
<td>21.65</td>
</tr>
<tr>
<td>Medial</td>
<td>361</td>
<td>19.26</td>
<td>8</td>
<td>8.25</td>
</tr>
<tr>
<td>Post-Dorsal</td>
<td>13</td>
<td>0.70</td>
<td>1</td>
<td>1.03</td>
</tr>
<tr>
<td>Total</td>
<td>1874</td>
<td>100</td>
<td>97</td>
<td>100</td>
</tr>
<tr>
<td>G.T.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1 - 5: Frequency of occurrences of the stops in the monosyllabic words in terms of Articulators.
Comments on Table 1 - 5:

1. A glance at the table shows that there are a total of 1978 occurrences of stops in the monosyllabic words. Out of these the apicals 667 (33.82%), top the list, followed by the labial 460 (23.25%), the dorsal 467 (23.61%), the medial 370 (18.71%) and the post-dorsal stops 14 (0.71%) in descending order. The figures and their respective percentage adequately suit our expectations regarding the effect of the hierarchy of the adroitness of articulators on the frequency of occurrences of the stops in the monosyllabic words.

2. A cursory glance of the figures and percentages for the CVC stops show that they are in accordance to our expectations. The apical stops 618 (32.98%) outnumber the almost equal labial stops 437 (23.52%) and the dorsal stops 445 (23.74%), which is what we expect.

   The medial stops, produced by the less adroit medium, account for 361 (19.26%) which is justified.

   The comparatively low figure for the post dorsal stops 13 (0.70%) is justifiable in the fact that they are produced by the least adroit post dorsum amongst the lingual articulators.

3. Of a total of 97 CVCC stops, the apical stops 48 (49.49%) comprise almost half of the total number of occurrences, which are followed by the labial stops 19 (19.58%), the dorsal stops 21 (21.65%), the medial stops 8 (8.25%) and the post dorsal stops 1 (1.03%) which is what we expect as a result of this hierarchy.
4. We have a total of 7 occurrences for the CCVC stops. Out of these 7, 1 (14.29\%) are apicals, 4 ((57.13\%) are labials and 1 (14.29\%) 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 such skewings can be explained in terms of vision, (Cf. chapter V.)
Section C2 (c) : Fricatives in Terms of Articulators in the Hierarchy of Adroitness: At 1, 1 1/2 and 2 Apertures

Here we compare the impact of hierarchy of adroitness of articulators on the apical and other fricatives (non-apical) in their frequency of usage in the monosyllabic words of Delhi Urdu. The frequencies of the opposing units are presented in Table 1 - 6:
Table I - 6: Frequency of occurrences of the Fricatives in the monosyllabic words in terms of Articulators.
Comments on Table I - 6:

1. As in the case of stops above, fricatives too are characterized by their preference for the most adroit apical articulator. Of the 396 fricatives in all the monosyllabic words, 261 (65.91%) are apical, 48 (12.12%) are labial, 49 (12.37%) are dorsal and 38 (9.59%) are medial and none occurrence of post-dorsal. Here the preference for apex remains at the top position on the scale of adroitness.

2. The vast skewing in favor of the apical fricatives is slightly increased among the CVC words. These words, with 358 occurrences of the fricatives, contain 236 (65.92%) apical fricatives, 39 (10.89%) labial fricatives, 48 (13.41%) dorsal fricatives, 35 (9.78%) are medial fricatives. This increase in the usage of the apical among the CVC words conforms to our expectation in terms of hierarchy of adroitness among all the lingual articulators.

3. In the CVCC words with 36 fricatives, there are 23 (63.90%) occurrences of the apical fricatives, 9 (25.00%) occurrences of the labial fricatives, only, 1 (2.77%) occurrence of the dorsal fricatives and 3 (8.33%) occurrences of the medial fricatives. This vast skewing against the non-apical fricatives is due to the fact that apex stands at position of scale of adroitness.

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.

A total skewing at the medial and post-dorsal order further justifies our claim of this hierarchy of articulators, where the medium and the post dorsum are less and least adroit among lingual articulators, respectively.
Section C.2 (iv): Liquids 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 the monosyllabic liquids through Table I - 7.
### Table 1 - 7: Frequency of occurrences of the liquids in the monosyllabic words in terms of Articulators

<table>
<thead>
<tr>
<th>Liquids</th>
<th>CVC words</th>
<th>CVCC words</th>
<th>CCVC words</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aperture (3)</td>
<td>No.</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Articulators</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apico-dental</td>
<td>405</td>
<td>3</td>
<td>11</td>
<td>419</td>
</tr>
<tr>
<td></td>
<td>82.32</td>
<td>25.00</td>
<td>84.62</td>
<td>81.04</td>
</tr>
<tr>
<td>Apical-palatal</td>
<td>69</td>
<td></td>
<td></td>
<td>69</td>
</tr>
<tr>
<td></td>
<td>14.03</td>
<td></td>
<td></td>
<td>13.35</td>
</tr>
<tr>
<td>Apical</td>
<td>474</td>
<td>3</td>
<td>11</td>
<td>488</td>
</tr>
<tr>
<td></td>
<td>96.35</td>
<td>25.00</td>
<td>84.62</td>
<td>94.39</td>
</tr>
<tr>
<td>Labial</td>
<td>4</td>
<td>1</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>0.81</td>
<td>8.33</td>
<td></td>
<td>0.97</td>
</tr>
<tr>
<td>Doral</td>
<td>4</td>
<td>1</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>0.81</td>
<td>8.33</td>
<td></td>
<td>0.97</td>
</tr>
<tr>
<td>Medial</td>
<td>10</td>
<td>7</td>
<td>2</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>2.03</td>
<td>58.34</td>
<td>15.38</td>
<td>3.67</td>
</tr>
<tr>
<td>Post-Dorsal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>492</td>
<td>12</td>
<td>13</td>
<td>517</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

G.T.
Comments on Table 1 - 7 :

1. It is to be noted that for the liquids, apical liquids predominate the position. Of the 517 liquids in monosyllabic words, contain 488 (94.39%) are apical, 5 (0.97%) are labial 5 (0.97%) are dorsal, and 19 (3.67%) are medial. The lowest occurrences of labio-dorsal (w) is due to the use of two oral articulators in its production. The skewing of medial liquids is clearly against our expectation from the viewpoint of the hierarchy of adroitness among the lingual articulators, this distribution is brought about by the human preference fewer versus more articulation (Cf. chapter II; section A). 

2. Among the liquids at aperture-3, we have a total 492 occurrences of the CVC words of Delhi Urdu. The apicals comprise a major chunk of the total i.e. 474 (96.35%) which shows that there is a clear preference for the apical liquids as compared to the labials, dorsals, medials and a total skewing against the post dorsal liquids. There is however an increase in the number of medial liquids which is 10 (2.03%) when compared to the dorsal liquid which is only 4 (0.81%). The rationale for this skewing is provided by the fact that in initial clusters the second member in either a 'y' or a 'w' in Delhi Urdu.

3. The CVCC liquids show a massive skewing in favour of the apical liquids. Out of a total of 13 CCVC liquids, all comprise of 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 apical and dorsals are however outnumbered by the use of the medial liquid which amounts to more than half of the total percentage i.e. 7 (58.34%). 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 increase.

Section C₂(e): Nasals in Terms of the Articulators in the Hierarchy of Adroitness

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 among the monosyllabic words through Table I-8:
### Table I-8: Frequency of occurrences of the Nasal in the Monosyllabic Words in terms of Articulators

<table>
<thead>
<tr>
<th>Nasals</th>
<th>CVC words</th>
<th>CVCC words</th>
<th>CCVC words</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apertures</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Apico-dental</td>
<td>185 57.53</td>
<td>16 22.22</td>
<td>1 100</td>
<td>202 46.76</td>
</tr>
<tr>
<td>Apico-palatal</td>
<td>9 12.50</td>
<td></td>
<td>9 2.08</td>
<td></td>
</tr>
<tr>
<td>Apical</td>
<td>185 51.53</td>
<td>25 34.72</td>
<td>1 100</td>
<td>211 48.84</td>
</tr>
<tr>
<td>Labial</td>
<td>148 41.23</td>
<td>6 8.33</td>
<td></td>
<td>154 35.65</td>
</tr>
<tr>
<td>Dorsal</td>
<td>26 7.24</td>
<td>37 51.39</td>
<td></td>
<td>63 14.58</td>
</tr>
<tr>
<td>Medial</td>
<td></td>
<td>4 5.56</td>
<td></td>
<td>4 0.93</td>
</tr>
<tr>
<td>Post-Dorsal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>359 100</td>
<td>72 100</td>
<td>1 100</td>
<td>432 100</td>
</tr>
</tbody>
</table>

**G.T.**

---

Table I-8: Frequency of occurrences of the Nasal in the Monosyllabic Words in terms of Articulators
Comments on the Table 1-8:

1. A look at the total figures for the apical, labial, dorsal and medial nasals clearly shows the preference for the apical nasal followed by the labials, dorsals and the medials. The apicals produced by most adroit apex, comprise slightly lower than half of the total number and percentages here, 211 (48.84%).

   The labial 154 (35.65%), the dorsal 63 (14.58%) and the medials 4 (0.93%) conform to our expectation regarding this hierarchy of the adroitness of articulators.

2. Among the 359 occurrences of the nasals in the CVC words, there are 185 (51.53%) are apical, 148 (41.23%) are labial, and 26 (7.24%) are dorsal. It shows clear favoring for apical articulator. It is to be noted that for nasals, apical and labial articulators predominate the position. Here the medial nasals do not occur, because medium has lowest position on the scale of adroitness. Irrespective of the point made about the absence of medial nasals, we find clear favoring for apical nasals.

3. Among the 72 nasals occurring in the CVC words there are 25 (34.72%) apical, 6 (8.33%) are labial, 37 (51.39%) are dorsal, and 4 (5.56%) are medial. In the dorsal we find the unexpected skewing in terms of the hierarchy of articulators, which can be explained in terms of assimilative trait. (cf. chapter II section C).
And finally, a look at the figures for the CCVC nasals show a total skewing in favour 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 C2 (f) : Concluding Remarks

To sum up section - C2 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 Delhi 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, 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.

4. To conclude, we can say that the impact of the hierarchy of the adroitness of articulators gives us massive skewing in favor of the apical consonants, followed by the labial-dorsal, medial and the post dorsal consonants in the words in Delhi Urdu.

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 is preferred over remote points of articulation.

6. We have also encountered instances when we have unexpected high figure for the less favoured medial consonants. We have provided suitable rationale for such type of skewing.
Section C3: Summary Statements

We present a brief summary on the various aspects and effects 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 0 through 3. It is the result of the high adroitness of the apex that the apical consonants outnumber the non-apical consonants, both in their paradigmatic make-up and their syntagmatic distribution. The apicals outnumber the dorsal, medial and labial consonants when analyzed 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, liquids and nasals. In each case we conclude that the physiologically based hierarchy of the adroitness of articulators plays a significant role in the make-up and distribution of the phonological units in Delhi Urdu.
Section D: The greater Mass of the Tongue (Medium-Dorsum) and the Production of vowels

In the production of phonological units of 4-8 apertures, lingual articulators involved are medium and dorsum.

The non-apical portions of the tongue have greater physical mass than the apex. The lesser physical mass of the apex results into greater mobility for apex. The medium and dorsum have greater physical mass and physiologically less mobile than the apex of the tongue. We discuss in section D above, that greater mobility of the apex of the tongue produces skewings in favor of apical consonants vis-a-vis non-apical consonants.

In this section, an attempt is made to explain the effect of greater physical mass of medium and dorsum on the production of units of apertures 4-8 (vowels).

In the production of vowels, the articulators do not block or restrict the air channel, but here the articulators have to control the big cavity from tongue (or lips) to larynx. The cavity is very large and it demands a heavy organ to control its enormous size. Since the non-apical portions have greater physical mass than the apex, so they are physiologically more appropriate than the apex which has less physical mass.

When we examine the phonological Grid of Delhi Urdu in the light of the above placements, is an observed that in Delhi Urdu, only medium and dorsum are used in the Production of vowels. Thus, we get 100% skewing in favor of medium and dorsum in the production of vowels. This skewing is definitely caused by greater physical mass of medium-dorsum.
Section E: Summary and Conclusions:

In this section, we summarize our findings as a whole for this chapter.

Section A of this chapter deals with the postulation of phonological units of Delhi Urdu in terms of two physiological variables, namely, articulators and aperture. The phonological units are presented diagrammatically in the Phonological Grid. (Diagram-I). The Phonological Grid is a network of horizontal and vertical lines, representing eight articulators and nine apertures. Degrees of apertures are subjected to two broad divisions. The first one divides the units into constriction apertures and opening apertures. The constriction apertures represent consonants and opening apertures signify vowels. The second division draws a line between resonants (nasals, liquids and vowels) and non-resonants (stops and fricatives). There are sixty-four phonological units in Delhi Urdu, of which three Aspiration (A), Nasality (N) and Voicing (V) are highly abstract units.

Phonological units in the Grid are not only characterized by their specific phonetic substance, which can be identified in terms of physiological mechanism, but they are also characterized by the value relationship that is they are interrelated with one another in the entire paradigm. Phonological Grid is different from the phonemic inventory in two major respects, first, phonological grid is organized in terms of articulators and apertures. Second the positional variants, too, if they fall on intersection of relevant articulators and apertures are elevated to the status of the phonological units.
In section B of the chapter under review, an attempt is made to explain the impact of the distribution of air stream on the combinatory pattern of phonological units. Two aspects of the combinatory pattern in the monosyllabic words of Delhi Urdu phonology are dealt with in terms of the distribution of the air stream. First, we take up repetition of unaspirated and aspirated consonants, through the frequency counts, it is shown that two aspirated units are never repeated in Delhi Urdu because aspirated consonants are greater amount of air flow as compared to unaspirated consonants under the second aspect of combinatory pattern in the monosyllabic words, we dealt with relative frequency of CVC, CCVC and CVCC words, here too, it is demonstrated that since consonants require greater effort and hence more source of air in their production as compared to vowels, therefore, CVC words where there is break between two consonants are preferred to CCVC and CVCC words which have two consonants in succession.

Section C of the chapter under review, deals with the hierarchy of mobility of articulators for lingual articulators in the production of consonants for monosyllabic words of Delhi Urdu. Defacto placement of labium on the scale of mobility is also discussed. It is found that the apex of the tongue stands at the top of the hierarchy of mobility and medium lies at the bottom of the mobility scale. Labium and dorsum lie midway between apex and medium. The difference in the hierarchy of adroitness of these articulators are due to their different shape, size and masculature. The greatest adroitness of apex among all lingual articulators and labium, increases the use of apex vis-a-vis non-apical
articulators in the production of consonants. It is due to the top position of apex on the scale of hierarchy of adroitness, that apical consonants out number non-apical consonants both in number of units and in their respective frequencies. Due to the lowest position of medium on the scale of adroitness, medial consonants are least frequent both in terms of number of units and in frequency count. The effect of hierarchy of adroitness on lingual articulators and labium for consonants is shown through the number of units produced by each articulator and their tabular frequencies for stops, fricatives, nasals and liquids in the combined occurrences of CVC, words.

In section D, the last section of the chapter under review, an attempt is made to explain the impact of greater mass of medium-dorsum on the production of vowels. It is shown that for vowels only medium and dorsum are used as articulator because these are heavy portions of tongue and are physically appropriate for controlling the big cavities formed in the production of vowels. This fact is established by noting the absence of apex as articulator for vowels.

In the chapter under review, we have tried to assess the role of physiology of vocal tract or physiological mechanism in the non-random make-up of phonological units of Delhi Urdu, on both the syntagmatic and paradigmatic levels. It has been demonstrated that it is the shape, size mass, musculature, relative adroitness of the vocal organs and the distribution of airflow that play leading role in the production of phonological units and their combinatory pattern in Delhi Urdu phonology.