2. AN OUTLINE OF GENERATIVE PHONOLOGY

2.1. Taxonomic Phonology

Taxonomic phonology is a term coined by Generative phonol., it is applied to that particular school of phonological studies which analyses phonemes at the phonemic level only. Taxonomic phonology maps the phonetic data onto a unilinear sequence of phonological segment. It sets up one overall inventory of phonological units for the language to be described and hence the Taxonomic model is unidimensional and nonsystemic.

2.1.1. Basic assumptions of Taxonomic phonology

Taxonomic phonology is based on two basic assumptions: (1) the phonology of a given language is a uniform system and (2) the phonological analysis should be carried out independently of grammatical analysis. Taxonomic phonology merely aims at segmentation and classification of speech sounds.

According to the Taxonomic model, discovering the phonemes is the first step. The second step is to define the nature of each phoneme in terms of its norm and range of deviation for each position in which it may occur and its positional distribution. The third and the final step is to study the phonemic system in its totality to find out the significant classes and subclasses into which the phonemes fall. The
basis of classification are common phonetic, variational and distribu­
tional features. Taxonomic phonology thus uses the procedures of
segmentation and classification of speech sounds to proceed from the
data to the system of the language.

As already stated in the present section Taxonomic phonology
shuns all references to morphological facts or facts about the
grammatical structure of the language being investigated. Hockett (1943)
presents the philosophy of the Taxonomic school of phonology when he
says, "No grammatical fact of any kind is used in making phonological
analysis". Due to this autonomy of this school Taxonomic phonology
is also known as 'autonomous phonology'. This school of phonology
ignores the fact that many phonological facts are inextricably inter-
woven with grammatical facts and structural relationships.

2.1.2. Limitations of Taxonomic phonology

Chomsky (1964) proposes that a phonological analysis should
ideally be explanatorily adequate. He also distinguishes phonological
analysis which are observationally adequate from those which are
descriptively adequate. As Taxonomic phonology does not go beyond
the systematizing of phones into phonemes phonological analysis based
on this model is merely observationally adequate. Such an analysis
does not take into account the linguistic competence of the native speaker
and thus becomes descriptively inadequate. A Taxonomic phonological
study of Dinka states that there is the word /pai/ 'come' or the
word /bip/ 'hide' but not the word *bib. This description is, of course,
observationally adequate as it clearly states that certain forms are observed in this language while others are not. But this description is inadequate descriptively as it fails to state that *bib is not only not observed, it is not a possible word in this language as the sound segment /b/ cannot occur word finally in Biaasa. Taxonomic phonology fails to capture this segmental constraint of Biaasa though the native speakers have the 'knowledge' (competence) of this constraint.

As Taxonomic phonological analysis never reaches the level of descriptive adequacy any study based on this model is bound to be partial and incomplete. In English seat [sIt] and neat [nIt] occur but words like *ngseat [sIt] are not observed. Taxonomic phonology does not take into account why the nasal consonant [n] does not occur word initially while [n] and [n] do. 3

As stated in Sec. 2.1.1, phonologists working on Taxonomic model maintain that phonological analysis should be justified on the basis of phonetic variants alone. 'Mixing levels' is prohibited in Taxonomic phonology. But this principle of Taxonomic phonology makes phonological analysis incomplete as it fails to account for the apparent phonological irregularities found in the morphological structure of a language.

While studying Biaasa on a Taxonomic model we get the minimal pairs

/ion/ believe
/loB/ atone
and conclude that /n/ and /k/ are two distinct phonemes of this language. But when we find the morphophonemic change as

/ən/  I
/ani/  ay

in the related forms of Dimasa words we cannot account for the occurrence of /n/ in /ani/ while there is /k/ in /ak/. Cases of such morphophonemic changes are beyond the scope of Taxonomic phonology.

Now let us take an example from English. Taxonomic phonology postulates /k/ and /s/ as two distinct phonemes of English as we have the following minimal pairs:

- keen
- seen
- key
- sea

But in English we have phonemic representations of the related forms 'electric' and 'electricity' as

/elektrik/
/elektrisiti/

and Taxonomic phonology cannot state how the stem final consonant /k/ of /elektrik/ becomes /s/ in /elektrisiti/
Taxonomic phonology advocates the theory of once a phoneme always a phoneme. Due to its adherence to this formulation it fails to describe how two distinct phonemes of a language may be realized phonetically as the same sound. That /k/ and /g/ are two phonemes of Dimasa is proved by the following minimal pairs:

- /kin/ fear
- /gin/ two
- /kəlai/ do
- /gəlai/ fall

But in the following Dimasa words /k/ is phonetically realized as \[\kappa\]:

- /buku/ \[\text{Bugu}\] mouth
- /biki/ \[\text{Bigi}\] waste products

This changing of \[\kappa\] to \[\g\] in Dimasa words cannot be accounted for in Taxonomic phonology.

The following example taken from English also points out how Taxonomic phonology fails to account for the same phonetic realization of two distinct phonemes. That /t/ and /d/ are two distinct phonemes of English is established with the help of the following minimal pairs:

- tie
- die
- bat
- bad
But in the following words both /t/ and /d/ become phonetically a flap [D]. Examples:

writer [raɪtər]
rider [raɪdər]

If we follow the Taxonomic model and look for minimal pairs as the only evidence for phonology, we would have to conclude that [D] in these words represents the phoneme /D/ as it contrasts phonetically with other phonetic units such as the following:

riper [raɪpər]
rymer [raɪmər]
writer [raɪtər]
rider [raɪdər]
riser [raɪsər]

The native speakers of English intuitively know that 'writer' has a phonemic /t/ because of 'write' and 'rider' has a phonemic /d/ because of 'rider'. But Taxonomic phonology cannot state how [D] of 'writer' comes from /t/ and [D] of 'rider' comes from /d/.

It is the Generative phonology which can explain how the phonetic realization of two distinct phonemes may be identical in certain environments.

2.2. Generative phonology

Phonology is concerned with the sound structure of language and Generative phonology is a theory of this structure. Generative phonology...
maintains that phonology of a language cannot be described without any reference to morphology and syntax. A phonological study based on a generative model always accounts for the "knowledge" (which Chomsky refers to as linguistic competence) of the native speaker.

2.2.1. Basic assumptions of Generative phonology

Generative phonology considers the phonological structure of a language as having an underlying form. The underlying phonological elements of a language are called systematic phonemes which are actually decomposable as some sets of phonetic features. In the framework of generative phonology a phonological unit consists of a permitted sequence of these bundles of features. A set of transformational rules changes the underlying structure into the surface structure. In generative phonology phonemes are not the actual phonetic sounds — they are abstract constructs which are realized as sounds by the operation of phonological rules. The generative phonological description of a language includes a full list of all possible features, their possible groupings into systematic phonemes, the permitted sequences of these systematic phonemes and a list of transformational rules.

When we look into the sound structure of a particular language and notice morphemes which exhibit rule-governed phonological alternations we have to determine the underlying representation of each morpheme and to state phonological rules which transform underlying representation into derived representation. The underlying representation of generative phonology exhibits structural regularities which are not always apparent in the derived representation.
2.2.2. Its difference from Taxonomic phonology

Generative phonology rejects the phonemic level advocated by Taxonomic phonologists. Generative phonologists think that the phonemic level is not abstract enough, it is too close to the phonetic ground. Both Taxonomic phonology and Generative phonology recognize two levels of phonological representations. Taxonomic phonology recognizes the phonetic level --- the level of pronunciation and the level of contrast or opposition --- the phonemic. Generative phonology recognizes a level of pronunciation and an abstract level where the phonetic variance is reduced to the minimum. In Generative phonology these two levels are called (1) Systematic phonetic and (2) Systematic phonemic. Taxonomic phonemes of the Taxonomic phonologists contrast on the surface and the phonetic variance noticed at the level of pronunciation is termed as allophonic variations.

While morphological alternations are outside the purview of Taxonomic phonology Generative phonology tries to account for the morphological alternations. The relevance of grammatical category to phonological rules is an accepted assumption in Generative phonology. Taxonomic phonology, as already pointed out in Sec. 2.1.1., is totally independent of all grammatical facts of language.

Taxonomic phonology is merely observationally adequate (Sec. 2.1.2) while Generative phonology is adequate both observationally and descriptively.
2.2.3. Objectives of Generative phonology

2.2.3.1. Distinctive features

Generative phonology views segments as composed of sets of properties or features rather than indivisible entities. The features have their foundation in phonetics. When a phonetic feature is referred to as distinctive it implies that the '+' value of that feature found in certain forms contrasts with the '-' value of that feature found in other forms. Nasality /nasal/, for example, is a distinctive feature of English consonants but the same feature is non-distinctive for English vowels.

Distinctive features are valid for the description of any language and the system of distinctive features defines the set of articulatory and auditory possibilities that human beings can use to linguistic ends. Distinctive features are binary both at the phonetic level and the phonological level. The values of distinctive features are represented by the signs plus (+) and minus (-). The idea of a universal system of binary features was originally developed by Roman Jakobson. But subsequently the system proposed by Jakobson was modified by Chomsky and Halle.

The system of distinctive features provides a universal differential framework. It enables us to categorize different sounds of any given language in relation to each other, further it enables us to compare speech sounds across languages.
In 'The Sound Pattern of English' Chomsky and Halle proposed thirty-six distinctive features. The proposal put forward by Chomsky and Halle is not yet final, it is likely to be modified and restructured as knowledge of the phonology of languages improves.

The distinctive features relevant to the study of English and Maasa may be grouped into seven broad categories. These are: (1) the major class features, (2) the manner features, (3) the place of articulation features, (4) the body of tongue features, (5) the feature rounded, (6) the secondary articulation features and (7) subsidiary features.

2.2.3.1.1. The Major class features

The features \([\text{syllabic}]\), \([\text{sonorant}]\) and \([\text{consonantal}]\) are called major class features. They refer to properties related to syllabicity, sonority and the type of constriction. Vowels are generally \([\text{+syllabic}]\), whereas consonants are \([\text{-syllabic}]\). This feature also differentiates syllabic nasals and liquids (+syllabic) from their non-syllabic counterparts. The feature \([\text{sonorant}]\) refers to the medial or resonant quality of a sound. Vowels, nasals, liquids and semi-vowels are always \([\text{+sonorant}]\). The obstruants — stops, fricatives, affricates, laryngeal glides are \([\text{-sonorant}]\). The feature consonantal refers to the narrowed constriction in the oral cavity — either total or partial. While stops, fricatives, affricates, nasals and liquids are \([\text{+consonantal}]\), vowels and semi-vowels are \([\text{-consonantal}]\).
In some languages like Zimasa vowels are always syllabic and consonants non-syllabic and in such languages the specification \( \_{\text{syllabic}} \) becomes the formal means for referring to vowels and \( \_{\text{-syllabic}} \) to consonants. The matrix in Table A shows the relationship between the features \( \_{\text{syllabic}} \), \( \_{\text{sonorant}} \) and \( \_{\text{consonantal}} \).

### Table - A

<table>
<thead>
<tr>
<th></th>
<th>syllabic</th>
<th>sonorant</th>
<th>consonantal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vowels</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>glides</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>liquids &amp; nasals</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>obstruants</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

2.2.3.1.2. The Manner features

Features like \( \_{\text{continuant}} \), \( \_{\text{strident}} \), \( \_{\text{nasal}} \) and \( \_{\text{lateral}} \) distinguish sounds on the basis of their manner of articulation. Sounds with continuous friction through out are \( \_{+\text{continuant}} \) and those beginning with total occlusion are \( \_{-\text{continuant}} \). The fricatives are \( \_{+\text{continuant}} \) while stops and affricates are \( \_{-\text{continuant}} \).
The feature $\left[ \text{strident} \right]$ marks sounds which are produced in such a way as to permit the airstream to pass through only a narrow opening in the centre of the vocal tract. In producing the stridents the outgoing air hits the teeth or the uvula. Fricatives are always $\left[ +\text{strident} \right]$. Affricates are also generally $\left[ +\text{strident} \right]$. Sounds which are neither fricatives nor affricates are $\left[ -\text{strident} \right]$.

The features $\left[ \text{nasal} \right]$ and $\left[ \text{lateral} \right]$ specify the properties capable of showing the distinction among the sonorants. Nasal consonants and both vowels and consonants with secondary nasalization have the feature $\left[ +\text{nasal} \right]$. Sounds made by diverting the airstream laterally around the tongue are $\left[ +\text{lateral} \right]$.

The matrix in Table 8 shows the relationship between the features $\left[ \text{continuant} \right]$ and $\left[ \text{strident} \right]$.

<table>
<thead>
<tr>
<th></th>
<th>stops</th>
<th>fricatives</th>
<th>affricates</th>
<th>nasals</th>
<th>laterals</th>
</tr>
</thead>
<tbody>
<tr>
<td>continuant</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>strident</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

The feature $\left[ \text{nasal} \right]$ and $\left[ \text{lateral} \right]$ have same definitions in both distinctive feature theory and traditional phonetics.
2.2.3.1.3. The place of Articulation features

The features \( \text{anterior} \) and \( \text{coronal} \) serve to distinguish the major positions of articulation. Sounds made at or in front of the alveolar ridge are \( \text{anterior} \) and all sounds articulated farther back than the alveolar ridge are \( \text{coronal} \).

Sounds made by raising the apex or front of the tongue to form a partial or total obstruction are \( \text{anterior} \), others are \( \text{coronal} \).

Labials, dentals and alveolars are \( \text{anterior} \), vowels, palatales, velars, uvulars and pharyngeals are \( \text{coronal} \). Again, interdentals, alveolars and palatales are \( \text{anterior} \) but labials, velars, uvulars and pharyngeals are \( \text{coronal} \). Vowels are also \( \text{coronal} \).

The matrix in Table C shows the relationship between the features \( \text{anterior} \) and \( \text{coronal} \).

<table>
<thead>
<tr>
<th></th>
<th>vowel</th>
<th>labial</th>
<th>dental</th>
<th>alveolar</th>
<th>palatal</th>
<th>velar</th>
<th>uvular</th>
<th>pharyngeal</th>
</tr>
</thead>
<tbody>
<tr>
<td>anterior</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>coronal</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

2.2.3.1.4. The Body of Tongue features

The feature \( \text{coronal} \), as stated in the previous section, is defined by the position of the blade of the tongue. The placement of the body of the
tongue in certain specified positions also determine certain classificatory features. At the time of normal breathing the body of the tongue i.e. the part which lies behind the blade, remains relaxed on the floor of the mouth. While producing \[ a \] the blade of the tongue does not move, but the body is raised and fronted slightly. This position of the body of the tongue is called 'neutral position' and this neutral position is used as an orientation mark for characterizing three features \[ \text{high} \], \[ \text{low} \] and \[ \text{back} \].

Sounds produced by raising the body of the tongue above the neutral position are \[ \text{high} \]. Sounds produced without such a raising of the body of the tongue are \[ \text{low} \]. Sounds produced by lowering the body of the tongue below the neutral position are \[ \text{low} \]. Sounds produced without such a lowering of the body of the tongue are \[ \text{low} \]. Sounds produced with the body of the tongue further back than the neutral position are \[ \text{back} \]. Others are \[ \text{back} \].

The features \[ \text{high} \] and \[ \text{back} \] characterize vowels as well as consonants. Both central and back vowels are \[ \text{high} \] and vowels made in positions higher than the neutral position are \[ \text{high} \]. Velar consonants such as \[ k \] and \[ g \] and the vowel \[ u \] are \[ \text{high}, \text{back} \]. Labial, dental and alveolar consonants such as \[ p \], \[ b \] and \[ t \] are \[ \text{low}, \text{back} \]. Palatals such as \[ j \] and \[ k \] are \[ \text{high}, \text{back} \].
The matrix in Table 3 shows the values of some consonants with reference to the features \( \text{high} \) and \( \text{back} \).

<table>
<thead>
<tr>
<th></th>
<th>p</th>
<th>b</th>
<th>t</th>
<th>d</th>
<th>k</th>
<th>g</th>
<th>( \tilde{z} )</th>
<th>j</th>
<th>s</th>
<th>( \tilde{s} )</th>
<th>f</th>
<th>( \theta )</th>
<th>l</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>high</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>back</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The following table shows how the body of tongue features interact to characterize some common vowels.

<table>
<thead>
<tr>
<th></th>
<th>i</th>
<th>u</th>
<th>( \varepsilon )</th>
<th>a</th>
<th>e</th>
<th>( \varrho )</th>
<th>o</th>
</tr>
</thead>
<tbody>
<tr>
<td>high</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>back</td>
<td></td>
<td>+</td>
<td></td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>low</td>
<td></td>
<td>-</td>
<td></td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.2.3.1.5. The feature rounded

Sounds produced with the rounding of the lips are \( \text{\textendash round} \) and sounds without such a rounding of lips are \( \text{\textendash round} \). As in the vowels presented in Table 2 in the previous section, \( \text{\textendash round} \) and
The body of tongue features and the feature rounded characterise certain secondary articulations of consonants. Features $\overline{\text{high}}$, $\overline{\text{back}}$, $\overline{\text{rounded}}$ are involved in the secondary consonant modifications of palatalization and labialization. Table P given below presents some labialized, velarized and palatalized consonants with reference to features $\overline{\text{high}}$, $\overline{\text{back}}$ and $\overline{\text{rounded}}$.

**Table - P**

<table>
<thead>
<tr>
<th></th>
<th>$t^b$</th>
<th>$t^y$</th>
<th>$k^v$</th>
<th>$k^y$</th>
<th>$p^w$</th>
<th>$p^y$</th>
</tr>
</thead>
<tbody>
<tr>
<td>back</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>high</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>rounded</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

(Labialized $t$, $k$, $p$ are represented as $t^w$, $k^w$, $p^w$ respectively. Velarized $t$ is represented as $t^v$ and palatalized $t$, $k$, $p$ are represented as $t^y$, $k^y$, $p^y$ respectively.)
2.2.5.1.7. Subsidiary features

The feature [+voice] characterizes sounds whose articulations include periodic vibrations of the vocal cords, others are [-voice]. The feature [+tense] characterizes sounds made with relatively high tension in the muscles of the oral cavity, [-tense] sounds are lax and involve much less muscle tension.

Vowels, glides, nasals and liquids are normally [+voice]. Obstruants such as /p, t, k, f, v, s/ are also [+voice]. Again [+voice] obstruants are [-tense] and [-voice] obstruants are [+tense]. It is pertinent to note that the feature [-tense] is relevant mainly to the production of vowels, it is seldom used to identify consonants.

2.2.3.2. Constraints

Though human vocal organs are capable of producing a vast number of physically different sounds no language exploits all the possible sounds and hence we notice restrictions on inventories of sounds of a particular language. There are certain restrictions on the occurrence of sounds in a language. These restrictions or constraints may be segmental or sequential. Both segmental constraints and sequential constraints again come under two subtypes: (1) phonetic and (2) phonologic. Constraints can be thus divided into four different subcategories: (1) phonetic segmental constraint, (2) phonologic segmental constraint, (3) phonetic sequential constraint and (4) phonologic sequential constraint.
2.2.3.2.1. **Segmental constraint both phonetic and phonologic**

From an inventory of possible sounds English selects \( [\varepsilon] \) and \( [\partial] \) as in 'thin' and 'then' but Dimasa observes the restriction of selecting none of these sounds. This type of selectional restriction of sound segments are called segmental constraint. Since the phonetic segments \( [\varepsilon] \) and \( [\partial] \) do not occur in Dimasa not only do we have here a phonetic constraint we have a phonologic constraint as well. To express it in a different way, the sounds \( [\varepsilon] \) and \( [\partial] \) are absent in Dimasa both at the phonetic and phonologic levels.

2.2.3.2.2. **Segmental constraint phonologic but not phonetic**

As shown in the previous section a phonetic constraint implies a phonologic constraint. But the reverse of this implicational rule is not true. There may be phonologic constraint without there being a corresponding phonetic constraint. If the phonetic and the phonologic inventories of a language happen to be identical the same segmental constraints will apply to both the levels. However, both the inventories are rarely found to be composed of identical number of segments. Generally a phonetic inventory comprises more segments than the phonologic inventory and atleast some segments of the latter subsume more than one segment of the former.

The phonetic inventory of Dimasa shows three high front vowels \( [i \, \varepsilon \, \partial] \) but all of them come under the same phonologic segment \( /i/ \). The differences in the length feature are responsible for the divergence among these three phonetic segments and hence we say...
conclude that in Dimasa there is no phonetic segmental constraint of length. Since phonologically only one segment is postulated which subsumes all the three phonetically divergent segments we have to conclude that in Dimasa there is a phonologic constraint against combining vowel quality of /i/ with length. To take another example, in Dimasa voiceless bilabial plosive /p/ is realized as a voiceless fricative $\phi$ when /p/ is followed by a high vowel and voiced bilabial plosive /b/ is realized as a voiced bilabial fricative $\beta$. Following words illustrate these realizations:

\begin{itemize}
  \item /pinba/ \quad $\varphi$inba \quad to turn
  \item /gupu/ \quad $\varphi$u$p$u \quad white
  \item /punuba/ \quad $\varphi$unuba \quad to show
  \item /tip/ \quad $\varphi$ip \quad hide
  \item /gibi/ \quad $\varphi$ibi \quad true
  \item /buma/ \quad $\varphi$uma \quad mother
\end{itemize}

Since phonetically only one segment /p/ is postulated for $\varphi$ and $\varphi$ and only one segment /b/ for $\beta$ and $\beta$ the feature $\varphi$strident$ becomes irrelevant phonologically in the case of bilabial plosives. (Phonetically $\varphi$ and $\beta$ are $\varphi$strident$). Thus we may state that in Dimasa there is a phonologic constraint for the occurrence of bilabial fricatives though phonetically there is no such constraint.

To cite another example, phonetically Dimasa has three velar stops: $\lambda$, $\lambda^h$ and $\lambda$g$. Of these three segments $\lambda$g$ has neither a phonetic nor a phonologic constraint. Regarding $\lambda$g$
and \( \left[ k^h \right] \) we are to note that since we posit /k/ as the phoneme and \( \left[ k^h \right] \) as an environmentally determined variant of /k/, there remains no unit at the phonological level which combines aspiration with velar-ty. This implies that a phonologic constraint stands against the combinability of the feature velar-ty and aspiration. As \( \left[ k^h \right] \) is the aspirated variety of /k/ we have to conclude that at the phonetic level no phonetic constraint operates forbidding the combinability of velar-ty and aspiration.

2.2.3.2.3. Sequential constraint both phonetic and phonologic

Each language obeys sequential constraints imposed by itself. On both phonetic and phonologic levels there are restrictions on how segments can be sequentially combined.

Both phonetically and phonologically Dimaasa does not allow any word-initial or word-final cluster of consonants. In Dimaasa if a word begins with a \( \left[ +\text{consonantal} \right] \) segment the next segment must be \( \left[ +\text{vocalic} \right] \). The word-initial segment sequence of Dimaasa can be schematised as

\[
\text{If} \quad \left[ +\text{consonantal} \right] \left[ +\text{segment} \right]
\]

\[
\text{Then} \quad \left[ +\text{vocalic} \right]
\]

To cite another example from Dimaasa, in this language voiced stops do not occur word finally both at the phonetic and the phonologic levels.
In English not more than three consonants can occur morpheme-initially. Again, if a morpheme begins with three consonants the first one must be /a/. The phonetic as well as phonologic sequential constraints of English state that in a morpheme-initial cluster of three consonants a constraint exists for all the consonants except /a/ which is a [+strident, +anterior, +coronal, -voice] segment.

This sequential constraint of English consonants may be schematized as

\[
\text{If } \# \begin{cases} \text{syllabic} \mid \text{syllabic} \mid \text{syllabic} \end{cases} \quad \text{Then} \quad \begin{cases} \text{+strident} \mid \text{+anterior} \mid \text{+coronal} \mid \text{-voice} \end{cases}
\]

2.2.3.2.4. Sequential constraint phonologic but not phonetic

There are sequential constraints which pertain to the phonologic level but not to the phonetic level. In Dimasa word-medially consonant clusters occur phonetically but not phonologically. Following are the examples:

/bubili/  /Bubli/  time
/bupulam/  /Bupulam/  fat
/ha' trai/  /ha'trai/  star

In rapid speech word-medial consonantal clusters are formed by dropping vowel segments and in such a phonetic consonantal cluster the second
consonant must be either /r/ or /l/. This phenomenon states that in
Dimasa there is a phonologic constraint for a word-medial consonantal
ccluster though there is no such phonetic constraint.

2.2.3.2.5. Sequential constraint phonetic but not phonologic

There are sequential constraints which pertain to the phonetic
level but not to the phonological level. In Dimasa, for example,
phonologically a voiceless obstruant may be followed by a voiced obstruant
but not phonetically. Phonetically, the first obstruant takes on the
same value for the feature [voice] as is found in the second obstruant
and hence when a voiceless obstruant is followed by a voiced obstruant
phonologically the former becomes voiced phonetically. The following
related words prove this phenomenon:

/siapai/ song
but /ɾəsʌbdu/ is singing

/siŋ/ blow
but /ʃibdu/ is blowing

Above examples imply that there is a sequential phonetic constraint
for the occurrence of a voiceless obstruant followed by a voiced
obstruant but there is no sequential phonologic constraint for such a
sequence of a voiceless obstruant and a voiced obstruant.
2.2.3. Redundancy

Though each phonological segment of a language has a value for each distinctive feature all the feature specifications of a particular segment are not independent. Some of the feature values can be predicted on the basis of values for other features and the predictable features are called redundant features. Redundant features are non-distinctive.

Segment redundancies define the set of possible phones in a language. Again, redundancies may be either universal or language specific. Universal redundancies occur due to restrictions on combinations of features. That vowels are always [-sonorant] is an example of universal redundancy. Language specific redundancies occur as not all theoretically possible combinations of features are not always utilized in a language. In Dimasa, for example, a [-anterior] stop is always [-coronal] and hence the feature specification [-coronal] is redundant in the case of non-anterior Dimasa stops. This is an example of redundancy within a segment.

Due to restrictions on permitted sequences of phonemes (see 2.2.2.2.3) redundancies occur across segments also. Sequence redundancies state the set of possible shapes of morphemes. If a Dimasa morpheme begins with a consonant the next segment must be a vowel. Hence the feature specification [-vocalic] is redundant in a morpheme initial sequence of two segments where the first segment is [-sonorant]. This example implies that due to sequential constraints certain features of one segment may be predicted on the basis of certain features of another segment.
2.2.3.3.1. Morpheme Structure Rules

Phonological redundancy rules were first given a clear theoretical foundation in the Morpheme Structure Rules proposed by Halle (1959) to predict redundant phonological information in morphemes. According to the morpheme structure rules redundant feature specifications should be left blank in the underlying representation of morphemes. These blanks should subsequently be filled in with the appropriate plus or minus values in accordance with the morpheme structure rules. Halle maintained that the lexical matrices for morphemes should be partially specified so that redundant values are not shown in the matrices. In order to assess the redundancies and to frame morpheme structure rules only those feature specifications from which the greatest number of other specifications can be predicted are to be found out. Next, by factoring out all the redundancies from lexical entries only the unpredictable features are specified in the evaluation matrix. The morpheme structure rules enumerate the details and capture the redundancies on the phonological level.

Morpheme structure rules are of two types: Segment structure rules and sequence structure rules. Segment structure rules make statements about the feature composition of individual phonemes regardless of their context. In English each [+nasal] segment is [+voice]. The segment structure rules of English state that the value of the feature [+voice] may be left blank in [+nasal] segments, since this value is predictably '1'. 
Thus segment structure rules give information about systematic phonemes in isolation. Sequence structure rules make statements about possible sequences of phonemes. In English any segment following a morpheme initial nasal must be \( -\text{consonantal} \). The sequence structure rule of English shows that the value of the feature \( -\text{consonantal} \) may be left blank in segments immediately following a morpheme initial nasal, since this value is predictably \( '-' \) in this position.

Stanley (1967)\(^{10} \) has shown that there are difficulties with partially specified lexical matrices propagated by Katz. Inconsistencies may often arise due to the interaction of segment redundancies with sequence redundancies. In English, for example, \(/s/\) is specified as \( +\text{strident} \) and since \(/s/\) is \( +\text{strident} \), we can predict that it is \( -\text{syllabic} \). In a partially specified lexical matrix the value for the feature \( -\text{syllabic} \) remains unspecified. But the sequence redundancy rule of English states that if there are three \( -\text{syllabic} \) segments in a morpheme initial position (2.2.3.2.3), the first one must be /a/, \( +\text{strident}, +\text{anterior}, -\text{consonal}, -\text{voice} \). Hence in these clusters, the feature \( -\text{strident} \) may be left unspecified. But /s/ cannot be simultaneously unspecified for the feature \( -\text{syllabic} \) as well as for the feature \( -\text{strident} \), as required by segment redundancy rule and sequence redundancy rule respectively.

To cite an example from Biami, according to the morpheme structure rule of Biami /a/ is specified as \( +\text{low} \) with the value \( -\text{low} \) for the feature \( -\text{vocalic} \) unspecified. But in a word-final cluster...
of two vowels one of the vowels must be /a/ which is [low]. Thus in a cluster of two vowels word finally /a/ cannot be simultaneously unspecified for the feature [vocalic] as required by sequence redundancy and for the feature [low] as required by sequence redundancy.

2.2.3.3.2. Morpheme Structure Conditions

In order to overcome the limitations of morpheme structure rules, Stanley (1967) proposed that morpheme structure rules should be replaced by morpheme structure conditions. Morpheme structure conditions prohibit blanks in the underlying matrices. These conditions are designed to capture the redundancies of the underlying phonological level. For the operation of morpheme structure conditions all lexical representations should be fully specified. When we have fully specified lexical matrices we try to account for the greatest number of lexical entries with the help of the least number of morpheme structure conditions.

Stanley lists three kinds of morpheme structure conditions: (1) if-then condition, (2) positive conditions and (3) negative conditions. Schachter and Fomkin think that negative conditions may be replaced by if-then conditions. Thus if-then and positive conditions are sufficient for the theory of morpheme structure conditions.
An if-then morpheme structure condition of Dimasa states that

\[
\text{If } \left[ \text{+consonantal} \right] \# \\
\text{Then } \left[ \text{-strident} \right]
\]

This morpheme structure condition states that \( \left[ \text{-strident} \right] \) segments /s/ and /z/ cannot occur word-finally.  

Positive morpheme structure conditions are used to capture the phonological shape of morphemes. An example of positive morpheme structure condition of Dimasa is as follows:

\# V \#

This condition states that a Dimasa morpheme can be formed by a single vocalic segment.

Segment redundancies and sequence redundancies together form a set of morpheme structure conditions. A conceivable morpheme of a language is an arbitrary sequence of bundles of specified features.
2.2.4. Underlying representation

The concept of underlying representations of morphemes is an important assumption of Generative phonology. The approach adopted by Generative phonology is a deductive one in which we posit an inventory of abstract phonemic symbols and then state the rules for their realization in terms of combinations of articulatory features.

In their discussion on the Generative phonology of Bengali, Chatterjee and Sircar give the following examples of the abstract representation of the Bengali phoneme /d/.

\[ \text{\textdialect{cohe} + be} \Rightarrow \text{\textdialect{cohe} will be angry} \]

\[ \text{\textdialect{corb} + be} \Rightarrow \text{\textdialect{corb} will ride} \]

\[ /\text{\textdialect{d}}/ \text{is realized as} /\text{\textdialect{d}}/ \text{in} /\text{\textdialect{cohe}}/ \]

Taxonomic phonology will treat /\text{\textdialect{d}}/ and /\text{\textdialect{d}}/ as separate phonemes even though they are in contrastive distribution in /\text{\textdialect{cohe}}/ and /\text{\textdialect{corb}}/. But by positing an abstract representation /\text{\textdialect{d}}/ Generative phonology explains that /\text{\textdialect{d}}/ of /\text{\textdialect{cohe}}/ comes from /\text{\textdialect{d}}/ and hence the surface representation /\text{\textdialect{d}}/ is a morphological variation of the deep structure /\text{\textdialect{d}}/. Thus the underlying form /\text{\textdialect{d}}/ becomes /\text{\textdialect{d}}/ in surface representation when it is followed by a voiced bilabial stop is evident in the following words:
In English the final consonant of the morpheme /electric/ has different realizations — electric, electricity. Generative phonology suggests that electricity has the following abstract representation:

\[
\text{# elektrik + iti} \quad \text{(k → s)}
\]

vowel adjustment

Here \text{# elektrik + iti} \# is the abstract representation and \text{[elektrisitly]} is the surface representation.

In Dimaasa /nāN̥g/ 'wanted' and \text{[nāNgya]} 'not wanted' are two related forms. The phonological alterations found in these two surface representations are rule governed. \text{[nāNgya]} has the abstract representation as follows:

\[
\text{underlying form # nāN̥g + ya} \#
\]

velar stop insertion # nāNg + ya #

surface representation \text{[nāNgya]}
The underlying form is in many cases equivalent to one of the alternants. But there are cases where none of the alternants can be set up as the underlying form. In such cases all the alternants must be derived from an underlying form which coincides with none of them.

2.2.4.1. Morphophonemics

While discussing the limitations of Taxonaic phonology in Sec. 2.1.2, it was noticed that the phone $\ell^d$ belongs to two distinct English phonemes /t/ and /d/. Now the question arises if one phone can be assigned sometimes to one phoneme and sometimes to another phoneme. While English /t/ and /d/ contrast initially and finally they do not contrast intervocically as is evident in the pronunciations of 'writer' and 'rider'. The Prague school of phonologists maintain that in this case the opposition between /t/ and /d/ has been neutralized. To state it differently, initially and finally the opposition between /t/ and /d/ is constant while it is neutralizable intervocically.

To cite an example from Dimasa the phonemes /k/ and /g/ have a constant opposition word initially (Sec. 2.1.2). But the opposition is neutralizable word medially when /k/ occurs in between two high vowels. (In words like /buku/ 'mouth', /biki/ 'waste product' $\ell^d$ becomes $\ell^g$.)
To combat the problem of neutralization, Prague school of phonologists introduced the concept of archiphoneme. As the bilateral opposition between English /t/ and /d/ is neutralized intervocally the segment which occurs in this position of neutralization is neither a voiceless nor a voiced stop but a segment which shares all the properties common to /t/ and /d/. The underlying representation of 'writer' and 'rider' will be /raider/ where /d/ is an archiphoneme specified as [voiceless].

The underlying representation of the Diasea words 'buku' and 'biki' mentioned earlier in this section will be /buku/ and /biki/ respectively where /k/ is an archiphoneme which shares all the common properties of /t/ and /g/ and is specified as [voiceless].

What the Prague school phonologists call neutralization of phonemes has been termed as 'phonemic overlapping' by Bloch. Phonemic overlapping implies the possibility of assigning one phoneme sometimes to one phoneme and at other times to another phoneme.

In 'A Taxonomic and Generative study of Bengali phonology' Chatterjee and Misra discuss the following examples of phonemic overlapping concerning Bengali phonemes /c/, /ch, /j/ and /gh/.

In Bengali /c, ch, j, gh/ contrast mutually in initial and medial positions as is evident in the following words:
(1) /coi/ rice
/chal/ skin
/jal/ net
/jhal/ hot

(2) /bãce/ survives
/bache/ chooses
/baje/ rings
/bojhe/ understands

But both /o/ and /oh/ become /j/ when /o/ or /oh/ is followed by a voiced stop syllable finally. The changing of /c/ to /j/ or /eh/ to /j/ is noticed in the following words:

(3) /bajbar/ of surviving
/bajbar/ of choosing

If we consider the words mentioned in (3) above with the words mentioned in (2) the extent of phonemic overlapping becomes clear. That there is a certain relationship between Bengali /c/ and /j/ is missed by phonemic analysis and hence a more abstract level called morphophonemic level has to be postulated to account for the allomorphic changes in related forms. The basic unit of a morphophonemic level is called the morphophone. In a morphophonemic analysis one representation is given to each morpheme and all the allomorphs are derived from base form. In Bengali, the morpheme 'bãc' has two alternate allomorphs: /bãc/ and /bãj/. The allomorph /bãj/ occurs when the
final consonant is followed by a voiced stop and /b/ elsewhere.
The base form of the morpheme is to be written as \( \text{\{baC\}} \) where
\( \text{\{C\}} \) is the morphophoneme and this \( \text{\{C\}} \) is sometimes represented by
the phoneme /c/ and sometimes by the phoneme /j/.

Now let us examine the question of phonemic overlapping and
morphophonemics with reference to Edassa. In Edassa \( \text{\{p J} \) and
\( \text{\{b J} \) contrast initially as is evident in the following words:

\[
\begin{align*}
/pai/ & \quad \text{come} \\
/bai/ & \quad \text{dance} \\
/piba/ & \quad \text{to split} \\
/biba/ & \quad \text{to worship}
\end{align*}
\]

Of the two phonemes only /p/ occurs word finally as in the following
words:

\[
\begin{align*}
/\text{ra}zap/ & \quad \text{sing} \\
/\text{bi}p/ & \quad \text{hide}
\end{align*}
\]

Medially /p/ becomes /b/ when the former is followed by a voiced
stop word medially. The changing of /p/ to /b/ is noticed in the
following words:

\[
\begin{align*}
/\text{ra}zap/sing \text{ but } /\text{ra}zabdu/ & \quad \text{is singing} \\
/\text{bi}p/ \text{ hide but } /\text{bi}bdu/ & \quad \text{is hiding}
\end{align*}
\]
The words /raaptai/ 'song' and /biptai/ 'hiding' place retain /p/ as the voiceless bilabial plosive segment is followed by a voiceless segment.

The relationship between /raap/ and /raapaju/ can be explained satisfactorily with the help of morphophonemic analysis. /raap/ and /raapaj/ are two allomorphs of the base form \{ raap \} where \{ P \} is the morphophoneme which is sometimes represented by the phoneme /p/ and sometimes by the phoneme /b/.

The relationship between Dimnes /a#/ 'I' and /ani/ 'my' mentioned in Sec. 2.1.2. may also be explained by postulating a morphophoneme \{ H \} which is sometimes represented by the phoneme /a/ and sometimes by the phoneme /u/.

The discussion on morphophonemes may be concluded by examining the following allomorphic alternations of English:

<table>
<thead>
<tr>
<th>Compartment</th>
<th>Alternative</th>
</tr>
</thead>
<tbody>
<tr>
<td>knife</td>
<td>knives</td>
</tr>
<tr>
<td>wife</td>
<td>wives</td>
</tr>
<tr>
<td>thief</td>
<td>thieves</td>
</tr>
<tr>
<td>leaf</td>
<td>leaves</td>
</tr>
</tbody>
</table>

For these allomorphic alternations Harris proposes the morphophoneme \{ H \}. 'Knife' and 'knives' have the base form \{ nai\} which is sometimes realized as the allomorph /naif/ and sometimes as the allomorph /naif/. According to Harris each morphophonemic symbol represents a class of phonemes each of which occurs in a particular environment.
2.3. Suitability of Generative approach for a Contrastive study

Each language has a range of sounds by which it realizes its phonemes and the same sounds may realize different sounds in different languages. In English, for example, /a/ and /ɪ/ are two different phonemes but in Dimasa both the sounds 'a' and 'ɪ' belong to a single phoneme /a/. The sound 'l' is present in both English and Dimasa but the vocalization of /l/ in English is determined by the phonetic context while in Dimasa the phoneme /l/ has no allophonic variation.

Segments across languages may be compared at two levels: the phonetic and the abstract. At the phonetic level we can give a precise account of the phonetic properties of segments found in English and Dimasa. We can state how similar type of segments are realized for both the languages and the subtle differences between them. In this case we can compare both the languages with the help of a set of criteria—acoustic and physiological which is common to English and Dimasa. Here we may say that English vowel /i/ is more advanced than the Dimasa vowel /i/.

At the abstract level we may find out identical feature specifications for segments in both the languages though they may not be phonetically realized in the same way. At the abstract level of Generative phonology the values of features are binary and if we compare English and Dimasa at the abstract level we may state whether or not an attribute is present. Here we may state that both English and Dimasa do not use aspiration contrastively but while English has vowels which are opposed in tenseness in Dimasa the feature [tense] is not a distinctive feature for vowel phonemes.
It is very difficult to make a contrastive study in terms of the actual physical output of sounds. The degree of variability in sounds between individual speakers of either English or Dimasa will make such a comparison difficult. Even if we set up an inventory of norms to represent English or Dimasa speech sounds it will be a study of instrumental phonetics which is outside the scope of the present discussion. Our aim is not to state if 'i' sound occurs in both English and Dimasa but to find out how this sound is realized in both the languages. The comparison of English and Dimasa phonology at the abstract level will help us in discovering the groupings of sound features into sets.

The contrastive analysis at the abstract level is suitable from the pedagogic point of view also. For a Dimasa learner it is not so important how to make a closer or a lower vowel as when to use a closer or a lower vowel. The learning problem for him is to discover which features of sounds are distinctive and if identical underlying structures have different surface realizations. The difficulty of learning the pronunciation of English is due to the degree and nature of difference in the ways English and Dimasa organise their sound system in abstract and surface representations and the present study wants to find out the clues at the abstract level assuming that the abstract level is more important than the surface level.

Most of the Generative phonologists recognize only syntactic phonemes and they claim that the taxonomic phonemes of structural
linguistics are not relevant entities within a total phonological description. Hence, in conformity with the principles of Generative phonology this study also compares the systematic phonemes of Chinese with those of English.

2.4. Conclusion

The controversy of systematic phonemic versus taxonomic phonemic representations is now an old one and enough literature exists on the theory of Generative phonology. The brief outline underlying the theoretical framework of Generative phonology (precisely, Transformational Generative phonology) given in this chapter is not all inclusive. The notion of markedness, markedness conventions, rule ordering in Generative phonology ———— these topics are left outside the scope of the discussion done in this chapter. The present study gives more emphasis to the application of Generative phonology for a contrastive study and, hence, theoretical discussion has been done in bare outlines.21

2.5. NOTES AND REFERENCES


3. This limitation of Taxonomic phonology is removed by the sequence structure conditions of Generative phonology. See Chapter III, Sec. 3.4.1 where Sec. VIII accounts for the absence of velar nasal /H/ word-initially.

4. Morphophonemic changes and the rules responsible for such changes are discussed in Sec. 2.2.4.1.

5. Generative phonology here stands for what Hooper (1976) terms Transformational Generative Phonology.


8. See Chapter IV Sec. 4.1.1.2. for the distribution of /i/.


12. There is a functional difference between morpheme structure conditions and phonological rules. According to Stanley (1967), MSCs state the redundancies at the systematic phonemic level while phonological rules map systematic phonemic level onto the systematic phonetic level.

13. Morpheme structure conditions accept the morphemes as the basic phonological unit for expressing phonotactic constraints. Natural Generative phonology, of course, claims that the syllable and not the morpheme must be used to express phonotactic constraints. Hooper (1976) proposes Syllable structure conditions (SSC in brief) for stating sequences of syllables and segments. Hooper's model is, however, not used in the present thesis.


Examples of neutralisation and phonemic overlapping generally discussed in standard works on Generative phonology refer to Danish /t/ and /d/, English /t/ and /d/ or German /t/ or /d/. Examples from Bengali are given here for the novelty of the treatment.


According to Hooper (1976) the main difference between the Generative model propagated by Chomsky and Halle (referred to as Transformational Generative phonology by Hooper) and the Natural generative phonology proposed by Theo Vennemann in 1971 (Vennemann, T. "Natural Generative Phonology". Paper read at annual meeting of the Linguistic Society of America, St. Louis, Missouri, 1971) lies in the derivation of morphophonemic alternations.

Hooper (1976) suggests new formulations to the problem of abstractness in Generative phonology. She also proposes "True Generalisation Conditions (TGC)" on phonological rules. As the present study is not based on Hooper's model I did not think it necessary to analyse Hooper's radical approach. But it is to be mentioned that Kenstowicz and Kisnerberth (1979) have shown the limitations of Hooper's formulations. Referring to TGC Kenstowicz and Kisnerberth
(1979) maintain that it is flawed by an internal inconsistency. The arguments put forward by Kenstowis and Kissberth are quite convincing. Hooper's formulations are, therefore, no more tenable.

21. In Sec. 1.7. of Chapter I it has already been mentioned that the present contrastive analysis is not an end in itself, it has a practical import also.