Level Ordered Morphology and Phonology in Manipuri

Shobhana L. Chelliah
University of Texas

1. Introduction

A number of phonological rules in the Tibeto-Burman language Manipuri\(^1\) cannot be characterized without making reference to word formation processes in the language. In this paper, I give a description of such phonological rules and show that the interaction between morphology and phonology in Manipuri can be represented by postulating that the lexicon of language is level ordered (Kiparsky, 1982; Mohanan, 1986). As the linguistic literature available on the phonology and morphology of Manipuri is limited\(^2\), I will first present a description of the phonemic contrasts and a sketch of the word formation processes available in the language. This will be followed by a list of the relevant phonological rules and with an explanation of how these interact with word formation processes. This list will be used to illustrate the existence of level-ordering in the lexical phonology and morphology of Manipuri.

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\(^1\) Manipuri, also known as Methei or Metthlet, is a Tibeto-Burman language of the Kuki-Chin Group. The dominant Manipuri speaking population of about a million speakers is concentrated in the central valley of Manipur state which is located in Northeastern India. Small pockets of speakers are present in Assam, Bangladesh and Burma.

\(^2\) The grammars on Manipuri by Primrose (1887) and Pettigrew (1912) provide short sketches of the morphological and syntactic structures in the language. However, neither grammar makes more than a few impressionistic statements about phonological processes in the language. Devi (1979) and Bhat and Ningomba (1986) provide more exhaustive descriptions of the noun and verb morphology in Manipuri. Although both of these works recognize that some morphemes have allophonic variants, neither provides formal statements about the phonological processes in the language. The most detailed description of the sound system of Manipuri available is Singh (1975). As discussed in Chelliah (1986), Singh does provide an accurate description of the phonemic system but does not make reliable statements about or give an exhaustive description of the phonological processes in the language. Finally, in no previous descriptions of Manipuri has a connection been drawn between phonological and morphological processes in the language. Thus the formulation of the phonological rules and the level ordered analysis of their application presented in this paper is original. The analysis is based on data from the works by Primrose, Pettigrew, Devi, and Bhat and Ningomba cited above as well as my own notes and tapes gathered during fieldwork carried out in Delhi in 1984, Manipur State and New Delhi in 1986 and 1987.
2. Consonant and vowel phonemes of Manipuri

An inventory of the consonant phonemes in Manipuri is given in Figure 1.

**Figure 1. Chart of consonant phonemes**

<table>
<thead>
<tr>
<th></th>
<th>Labial</th>
<th>Alveolar</th>
<th>Palatal</th>
<th>Velar</th>
<th>Laryngeal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stops</td>
<td>p</td>
<td>t</td>
<td>c</td>
<td>k</td>
<td>kʰ</td>
</tr>
<tr>
<td></td>
<td>pʰ</td>
<td>tʰ</td>
<td>cʰ</td>
<td>kʰ</td>
<td>h</td>
</tr>
<tr>
<td>Fricatives</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nasals</td>
<td>m</td>
<td>n</td>
<td>ɲ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lateral</td>
<td></td>
<td></td>
<td>l</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semivowels</td>
<td>w</td>
<td></td>
<td>y</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Borrowed words exhibit the voiced unaspirated series /b, d, j, g/ and the voiced aspirated series /bh, dh, jh, gh/. The voiced aspirated stops occur in borrowed words only. The lateral /l/ varies freely with /n/ word finally; intervocically, /l/ is realized as [ɹ]. The aspirated palatal stop /cʰ/ is phonetically realized as [s] or [ʃʰ].

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3 The phonemic inventory of Manipuri given here differs from the one traditionally described for the language. For example, I have indicated that voiced stops are not part of the phonemic inventory of Manipuri: opposed to this is the phonemic inventory provided in Thoudam (1989) where /b, d, g, j/ are said to be phonemic in the language. The following minimal pairs are given as support:

1. p/b
   - ipok 'my white hair'
   - ibok 'my grandmother'

2. t/d
   - laiȳōn 'not living there'
   - layd̄ōn 'only the flowers'

3. k/g
   - layk̄ōn 'hard surface'
   - layḡōn 'one who buys all the time'

As shown in (i) undervowed voiced stops can be found; however, they are attested only in a small number of kinship terms such as in (iv). The forms are taken from Nameitrakpam (1989).

iv. a. ipibok 'grandfather'
   b. ibok 'my grandmother'
   c. abok iben 'grandmother'
   d. iben bok 'grandmother'
   e. ibun 'elder brother'
   f. ibay 'elder brother'
   g. d̄ada (t̄ada) 'elder brother'
   h. pabun 'father'
   i. babo (or pabo) 'father'

Example (ii) which purports to provide a contrast between /t/ and /d/ is suspect since the marker -d̄a which signifies 'only, exactly' has a variant -t̄a as in medut̄a 'only by that' (example from Chelliah, field notes). Similarly, the example given to show a contrast between /k/ and /g/ is questionable since the marker -gan 'to V habitually' has a variant -kən as in cotkəlli 'usually go' (example from Bhat and Ningomba 1986: 4.15). There is no apparent reason why the voiced stop should be considered the underlying one. I propose that the variant with the voiceless stop is the underlying one and that the voiced stops are derived by the application of a single voice assimilation rule (see section 4.1.1). The (non) application of this
consonants is established through the minimal or near-minimal pairs given in the Appendix.

An inventory of the vowel phonemes in Manipuri is given in Figure 2.

Figure 2. Chart of vowel phonemes

<table>
<thead>
<tr>
<th>front</th>
<th>central</th>
<th>back</th>
</tr>
</thead>
<tbody>
<tr>
<td>high</td>
<td>i</td>
<td>u</td>
</tr>
<tr>
<td>mid</td>
<td>e</td>
<td>o</td>
</tr>
<tr>
<td>low</td>
<td>a</td>
<td></td>
</tr>
</tbody>
</table>

The phonemic status of these vowels is established through the minimal or near-minimal pairs given in the Appendix.

A feature specification of the consonant phonemes is given in Figure 3 and a feature specification of the vowel phonemes is given in Figure 4.

Figure 3. Feature specification of the consonant phonemes

<table>
<thead>
<tr>
<th></th>
<th>p</th>
<th>pʰ</th>
<th>t</th>
<th>tʰ</th>
<th>c</th>
<th>cʰ</th>
<th>k</th>
<th>kʰ</th>
<th>m</th>
<th>n</th>
<th>ɳ</th>
<th>l</th>
<th>w</th>
<th>y</th>
<th>h</th>
</tr>
</thead>
<tbody>
<tr>
<td>syllabic</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>sonorant</td>
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<td>+</td>
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<tr>
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<td>nasal</td>
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<tr>
<td>strident</td>
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<tr>
<td>voice</td>
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<td>+</td>
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<td>-</td>
</tr>
<tr>
<td>spread glottis</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
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<tr>
<td>continuant</td>
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</tr>
</tbody>
</table>

rule is either lexically determined (see section 4.2.2) or governed by the tone of the stem (see Chelliah, in press).

Finally, there is good support for the view that /s/ and /ʃ/ are allophones of /ch/. First, the absence of /ch/ would constitute a noticeable gap in the symmetry of the phonemic system. Second, /s/ and /ʃ/ trigger rules such as DASP (see section 4.1.2), just like the other phonemes in the aspirated series, e.g. sən 'money'; kʰən 'bag'; səŋən 'purse'. As it is precisely the presence of aspiration that triggers the application of the rule, it is reasonable to assume that in these environments /s/ and /ʃ/ are underlyingly /ch/.
Figure 4. Feature specification of the vowel phonemes.

<table>
<thead>
<tr>
<th></th>
<th>i</th>
<th>e</th>
<th>ø</th>
<th>a</th>
<th>u</th>
<th>o</th>
</tr>
</thead>
<tbody>
<tr>
<td>syllabic</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>sonorant</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>consonantal</td>
<td>-</td>
<td>-</td>
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<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>high</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>
</tr>
<tr>
<td>back</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>round</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>tense</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

3. Morphological sketch of Manipuri.

Words in Manipuri can be derived by means of the phrase structure rules given in 1(a-f). 'W' stands for Word and 'enc' stands for enclitic. INFL refers to a single inflectional suffix (infl) or a sequence of inflectional suffixes. 'Suffix' stands for derivational suffix. ROOT signifies the word minus all formatives. As stated by the rewrite rule 1e, ROOT may be a single root (root) or a sequence of roots. Rule 1d captures the fact that in Manipuri words may have at most one prefix. Parentheses indicate optionality. Instantiations of the rules given in 1(a-f) are given in App. 1.

1. a. \( W \rightarrow W\text{enc} \)
   b. \( W \rightarrow \text{STEM (INFL)} \)
   c. \( \text{STEM} \rightarrow \text{STEM (suffix)} \)
   d. \( \text{STEM} \rightarrow (\text{prefix}) \text{ROOT} \)
   e. \( \text{ROOT} \rightarrow \{ \text{ROOT} \} \text{(root)} \)
   f. \( \text{INFL} \rightarrow \text{infl}_1, \text{infl}_2, \ldots, \text{infl}_n \)

Roots in Manipuri are nouns and verbs. Noun inflection is for gender (this is a recent introduction into the lexicon and is restricted to nouns which refer to occupation) and case (agentive, accusative, dative, locative, ablative, genitive, associative). Verb inflection is for tense (present, future), aspect (imperfect, perfect, progressive) and mood (interrogative, imperative, infinitive, indicative, irrealis, factive). A sequence of morphemes may indicate a single category: for example, yes-no questions are signaled through the suffixation of the interrogative suffix plus the suffix
for irreals mood (see example 35d) or by the interrogative suffix plus the suffix that signals the factive mood (see example 35c).4

The derivational processes in Manipuri are compounding, suffixation and prefixation. In 2, I provide a list of the types of intracategory and intercategory derivation available in the language.

2. A. Intracategory compounding
   i. \([N + V] \longrightarrow N\)
   ii. \([V + N] \longrightarrow N\)
   iii. \([N + N] \longrightarrow N\)
   iv. \([N + V][N + V] \longrightarrow N\)
   v. \([V + N][N + V] \longrightarrow N\)
   vi. \([V + V] \longrightarrow V\)

B. Intracategory suffixation: for example, \([V + \text{suffix}] \longrightarrow V\), which signals meanings such as:
   i. to do V to each other
   ii. to V by oneself
   iii. to habitually V
   iv. to V in a particular direction
   v. to V in a sequential relation with another action
   vi. to be the cause of V

C. Intercategory suffixation may be of the form:
   i. \([N + \text{suffix}] \longrightarrow V\), which gives the meaning 'to be N'
   ii. \([V + \text{suffix}] \longrightarrow N\), which signals meanings such as:
       a. on Ving
       b. when Ving
       c. during Ving
       d. while Ving
       e. after Ving
       f. because of Ving
       g. compared to N

D. Intercategory prefixation
   i. \([\text{prefix} + V] \longrightarrow N\), which gives the meaning 'mode of Ving'
   ii. \([\text{prefix} + V] \longrightarrow \text{ADJ}\), which gives the meaning 'being V-like'

---

4 The interrogative marker is coupled with the factive or irreals markers to relate truth condition values for propositions.
4. **Level-ordering in the lexical phonology of Manipuri**

I will now present phonological evidence for the existence of level-ordering in the lexical phonology of Manipuri. In section 3.1, the interaction of phonology and morphology will be established: a phonological rule is described, along with examples of its application and information specifying the morphological environment where the rule applies or fails to apply. In section 3.2, it will be shown how phonological rules can be ordered in conjunction with word formation processes to derive the attested forms, without making complex morphological statements in phonological rules.

4.1 The interaction of phonology and morphology

4.1.1 Voicing assimilation

Syllable-initial voiceless unaspirated stops are voiced between voiced segments, as formalized in R(ule)1.

\[
\begin{align*}
\text{R1:} & \quad \begin{array}{c}
\text{- continuant} \\
\text{- sonorant} \\
\text{- spread glottis}
\end{array} \quad \rightarrow \quad [\text{+voiced}] \quad \frac{\text{+ sonorant}}{\text{+ sonorant}}.
\end{align*}
\]

The Voicing Assimilation rule applies in a limited number of morphological environments. First, the Voicing Assimilation rule applies when the infinitive marker \(-pə\) is suffixed to a verbal root that ends in a voiced segment. This is illustrated in examples 3(a,b). As shown in examples 3(c,d), when the root does not end with a voiced segment, the initial stop of the infinitive suffix does not become voiced.

3. root root + infinitive marker \(-pə\)

a. cā 'eat' cābə 'to eat'
b. pə 'good' pəbə 'to be good'

---

5 Notational conventions used:
- (.) signifies a syllable break
- (+) signifies a morpheme break
- (*) signifies an ungrammatical form
- (/\) signifies a phonemic representation
- (\[\]) signifies a phonetic representation

6 In section 4.1.7 an explanation is given for the necessity of specifying that the consonant to be voiced is syllable initial.
c. pik 'small'  pikepø 'to be small'
d. lak 'come'  lakedø 'to come'

Second, the Voicing Assimilation rule applies when one of the case markers -ki 'genitive', -kə 'associative', or -tə 'dative' is suffixed to a nominal root that has a final voiced segment. This is illustrated in examples 4(a-c). As shown in examples 4(d-f), when the nominal root has a final voiceless segment, the initial stop of the suffix does not voice.

4. root

root + case marker -ki, -kə, or -tə
a. tha 'moon'  thagi 'of the moon'
b. mi 'man'  mige 'with the man'
c. cin 'hill'  cinde 'on the hill'
d. phurit 'shirt'  phuritki 'of the shirt'
e. khus 'hand'  khute 'with the hand'
f. lempak 'ground'  lempake 'on the ground'

The Voicing Assimilation rule also applies when the initial voiceless stop of a root occurs between two voice segments in some compounds. As illustrated in example 5(a-d), the Voicing Assimilation rule applies in N + V, N + N and [[N + N] + N] compounds.

5.

a. lemboybø  b. unbantha  c. kumjin  d. nombo
   lem-pøy-pø  un-pan-tha  kum-cin  nom-po
   noun-verb-uderu  noun-noun-noun  noun-noun  noun-verb
   path-wander-agen  ice-rule-month  year-border  back-carry
   'wanderer'  'winter'  'early part'  'bundle'
   of the year

Finally, the Voicing Assimilation rule applies when the derivational suffixes -thok 'out' or -khat 'up' are suffixed to roots ending in a voice segment. In example 6(a-c), the initial aspirate of the suffix is deaspirated (see the Deaspiration rule below), thus providing the necessary environment.

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7 Examples of compounds or polymorphemic words are presented in bundles of five lines where:
- the first line represents a phonetic transcription of the word
- the second line gives a morphemic analysis of the word
- the third line gives the category of the morphemes
- the fourth line gives a gloss of the individual morphemes
- the fifth line gives a gloss of the entire word.

8 The derivational suffixes -thok and -khat are derived from the verb stems -thok 'occur' and -khat 'strike', respectively. Thus in 24a and 25b -thok appears as a stem.
for the application of the Voicing Assimilation rule. Therefore, a final statement about the phonological processes in Manipuri must order the Deaspiration rule before the Voicing Assimilation rule. Example 6(a-b) illustrates the voicing of deaspirated voiceless stops between voiced segments; in example 6c where the root ends with a voiceless segment, the initial deaspirated consonant of the suffix remains voiceless.

6. root root + derivational suffix \(-\text{thok}, \,-\text{khot}\)
   a. \(\text{hi} \) 'trim' \(\text{hidok} \) 'trim outwards'
   b. \(\text{thiŋ} \) 'pierce' \(\text{thiŋkot} \) 'pierce upwards'
   c. \(\text{khik} \) 'sprinkle' \(\text{khikkot} \) 'sprinkle upwards'

   In examples 3-6 it has been shown that the Voicing Assimilation rule applies with the process of suffixation or compounding. In examples 7-8 it will be seen that the Voicing Assimilation rule does not apply with prefixation or with compounds where the initial stem acts like a prefix. In example 7(a,b) for instance, the Voicing Assimilation rule does not apply with the affixation of the pronominal prefix \(\text{i} \) - 'first person possessive' or \(\text{mø} \) - 'third person possessive' where the root initial \(p\) in \(\text{pa}\) and \(\text{pu}\) does not voice even though it occurs between voiced segments.

7. root pronominal prefix \(\text{i} \), \(\text{mø} \) + root
   a. \(\text{pa} \) 'father' \(\text{ipa} \) 'my father'
   b. \(\text{pu} \) 'grandfather' \(\text{møpu} \) 'his/her grandfather'

   The Voicing Assimilation rule also does not apply with the affixation of the attributive prefix \(\text{ə} \) - as shown in example 7(c-d), where the root initial voiceless stops \(t\) and \(p\) do not voice even though they occur between voiced segments.

7. c. \(\text{ətənbe} \)
    \(\text{ə-ten-pe} \)
    \text{vdenu-verb-vinf}l
    att-short-inf
    'that which is short'

   d. \(\text{əpakpə} \)
    \(\text{ə-pak-pe} \)
    \text{vdenu-verb-vinf}l
    att-broad-inf
    'that which is broad'

   Similarly, the Voicing Assimilation rule does not apply with the prefixation of \(\text{mø} \) - which means 'method of Ving'. As shown in example

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9 Refer to Section 4.2.2 for further discussion of compounds of this type.
7(e-f), the root initial voiceless stops \( p \) and \( k \) do not voice even though they occur between voiced segments.

<table>
<thead>
<tr>
<th>7.</th>
<th>e.</th>
<th>mepa</th>
<th>f.</th>
<th>meken</th>
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<tr>
<td></td>
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<td></td>
<td>mode-read</td>
<td></td>
<td>mode-dry</td>
</tr>
<tr>
<td></td>
<td></td>
<td>'way of reading'</td>
<td></td>
<td>'way of being dry'</td>
</tr>
</tbody>
</table>

Also, the Voicing Assimilation rule does not apply in the \([N + N], [N + V], [V + V] \text{ or } [V + N]\) compounds given in example 8(a-f).

<table>
<thead>
<tr>
<th>8.</th>
<th>a.</th>
<th>ika</th>
<th>b.</th>
<th>heykon</th>
<th>c.</th>
<th>ecapot</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td>noun-verb</td>
<td></td>
<td>noun-noun</td>
<td></td>
<td>uderu-verb-noun</td>
</tr>
<tr>
<td></td>
<td></td>
<td>water-rise</td>
<td></td>
<td>fruit-place</td>
<td></td>
<td>att-eat-thing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>'flood water'</td>
<td></td>
<td>'orchard'</td>
<td></td>
<td>'food'</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>d.</th>
<th>mitop</th>
<th>e.</th>
<th>lupew</th>
<th>f.</th>
<th>paminnə pb</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>noun-verb</td>
<td></td>
<td>noun-verb</td>
<td></td>
<td>verb-verb-vinf-vinf</td>
</tr>
<tr>
<td></td>
<td></td>
<td>man-distinct</td>
<td></td>
<td>head-rough</td>
<td></td>
<td>read-company-recip-inf</td>
</tr>
<tr>
<td></td>
<td></td>
<td>'stranger'</td>
<td></td>
<td>'dandruff'</td>
<td></td>
<td>'read together'</td>
</tr>
</tbody>
</table>

Finally, the Voicing Assimilation rule does not apply in loan words. This is illustrated by the Hindi loan words given in example 9(a,b) where the voiceless stops \( p \) and \( k \) do not voice in intervocalic position.

| 9. | a. | tupi 'hat' | b. | tikə 'vaccination' |

4.1.2 Deaspiration

An aspirated consonant is deaspirated when it is preceded by an aspirated consonant or /ʔ/. This process is formalized in the Deaspiration rule (R2).\(^{10}\)

R2: \([- \text{sonorant}] \rightarrow [- \text{spread glottis}] / [+ \text{spread glottis}] \)

\(^{10}\) This rule is described and supported with the examples given here in an informal way in Bhat and Ningomba (1986). Additional data and discussion of this phenomenon are available in Thoudam (1989).
The Deaspiration rule applies when the derivational suffixes -thok 'out' or -khot 'up' are suffixed to roots which begin with an aspirate. The application of the Deaspiration rule is illustrated in example 10(a-c).

10. root root + derivational suffix -thok, -khot

- a. thiq 'pierce' thiqhot 'pierce upwards'
- b. khik 'sprinkle' khikhok 'sprinkle upwards'
- c. hi 'trim' hidok 'trim outwards'

As illustrated by examples 11(a-c), the Deaspiration rule also takes place in certain compounds. In example 11a, the aspirate of the second root of the three root compound deaspirates, but the aspirate of the third root does not. Thus the Deaspiration rule applies with the compounding of phi-pha'va but not with the formation of phi-pha'va-pem.\(^{11}\)

11. a. phi-pha'va-pem b. phi-da c. phi-ga

- noun-verb-noun noun-verb noun-verb
- cloth-dry-place cloth-spread cloth-in
- 'place for drying clothes' 'mat' 'inner garment'

Other compounds where the Deaspiration rule does not apply are given in example 12(a-c), where a second syllable aspirate does not deaspirate even though the first syllable of the form contains an aspirate.

12. a. phi-kha b. khon-tha c. thaw-thi

- noun-verb noun-verb noun-noun
- cloth-obstruct voice-relay oil-dung
- 'curtain' 'echo' 'oil cake'

4.1.3 Trilling

In intervocalic position, the alveolar lateral l becomes a voiced alveolar trill r. This process is formalized in R3.

R3: [+ lateral] \(\longrightarrow\) [- lateral] / [+ syllabic] \(\longrightarrow\) [+ syllabic]

---

\(^{11}\) Note that the [(N + V) + N] bracketing for phi-pha'va'pem is based on the observation, reflected in the rewrite rule 1e, that compounds usually branch to the right in Manipuri.
The application of the Trilling rule is illustrated in examples 13(a-c), where the first person possessive i-, the third person possessive mə-, and the attributive marker ø- are respectively prefixed to a root with an initial lateral-vowel sequence.

13. a. laybak 'land'   iraybak 'my mother land'
    b. lan 'property'   məran 'his property'
    c. lemə 'remaining' øremə 'remainder'

The Trilling rule also applies when the perfect aspect marker -lə or the progressive marker -lɨ is suffixed to a stem with a final vocalic segment. This is illustrated in example 14(a,b).

14. a. care                  b. cari
    ca-lə-e                ca-li
    verb-utnfl-enc          verb-utnfl
    eat-perf-exper          eat-prog
    'has eaten'             'eating'

The Trilling rule also applies when: the morpheme -lə 'action takes place towards the speaker' (15a); the morpheme -lɨu 'action takes place away from the speaker' (15b); the morpheme -ləm 'sequential' (15c); or the derivational suffix -lək 'come and do something' (15d) is suffixed to a root ending with a vocalic segment.

15. a. phərey     b. phəruy     c. caremmi   d. layrəkpeni
    phə-lə-i     phə-lu-i     ca-ləm-i   ləy-lək-pə-ni
    verb-uderu-utnfl verb-uderu-utnfl verb-uderu-enc verb-uderu-utnfl
    good-tdír-pres good-adír-pres seat-seq-exper buy-dsource-inf-
    'came here'   'went there'   'ate and went'   'is bought'
    and is good'   and is good'   away'

The Trilling rule also applies in some compounds as illustrated in the [N + N] and [N + V] examples in 16(a-d).

16. a. miraŋ     b. layrəybak     c. phiruk     d. phiren
    mi-laŋ     lay-rəy-pak     phi-luk     phi-len
    noun-noun  noun-noun-verb noun-noun noun-verb
    spider-snare god-land-broad cloth-basket cloth-best
    'cobweb'   'heaven'      'laundry basket' 'best cloth'
However, as illustrated by example 17, the Trilling rule does not apply in phrasal compounds or as seen in example 18, the rule does not apply across words.

17. vari lībe
   wa-li li-pe
   noun-verb verb-inf
   word-tell tell-inf
   'narrate a story'

18. cēyne lakpe
   cēy-ne lak-pe
   noun-case verb-inf
   stick-agent come-inf
   'stick by controlling'

4.1.4 Total Assimilation of 1

The alveolar lateral 1 assimilates in place and manner of articulation with a preceding nasal. This rule of total assimilation of 1 is formalized in R4.

R4: [+ lateral] ——> + nasal
      β anterior
      γ coronal
      β Feature
      γ Feature

The rule of Total Assimilation of 1 applies when the derivational affixes -1ə ‘action takes place towards the speaker’, -1u ‘action takes place away from the speaker’, -1ək ‘come and do something’, and -1əm ‘sequential’ are suffixed to a verbal root or stem ending in a nasal. This is illustrated in example 19(a-d) where the initial lateral of the suffix assimilates to the final segment of the verbal root. In 19a the final consonant of the suffix -1əm geminates under the influence of the following present tense marker. Refer to the Gemination Rule (R7) for further discussion of this process. In 19c the final consonant of -1ək is changed to a glottal stop under influence of the following present tense marker. Refer to the rule of k to Glottal Stop (R9) for further discussion of this process. Also note that in example 19b, a diphthong is created when the present tense marker is suffixed to the morpheme -1ə. See R10 for further discussion of diphthongization.
19.  a ȝəŋəməmi  b. laməməy  c. phəməʔi  d. inŋuy
    ȝəŋ-lem-i  lam-ле-и  phəm-lek-i  inŋ-lu-i
    verb-uderv-vinfl  verb-uderv-vinfl  verb-uderv-vinfl  verb-uderv-vinfl
    look-seq-pres  hungry-adir-pres  it-dsource-pres  cold-tdir-pres
    'comes and looks'  'came here and  'came sitting  'went there and
    is hungry'  (as on a bus)'  feels cold'

          The rule of Total Assimilation of ɬ also applies when the inflectional
          affixes -li 'progressive aspect', -lo'y 'negative future', or -lə 'perfect
          aspect', are suffixed to a verb stem. This is illustrated in example 20(a-d).

20.  a ȝəŋi  b. temmoy  c. semmi  d. ȝəŋe
    ȝəŋ-li  tem-loy  sem-li  ȝəŋ-lə-e
    verb-vinfl  verb-vinfl  verb-vinfl  verb-vinfl-enc
    see-prog  learn-negfut  arrange-prog  see-perf-exper
    'is looking'  'will not learn'  'is arranging'  'have seen'

          However, there are morphological environments where the rule of
          Total Assimilation of ɬ does not apply. For instance, in the compounds in
          example 21(a-b), the initial lateral ɬ of the second stem of the compound,
          does not undergo the rule of Total Assimilation of ɬ even though the
          phonological environment for the application of the rule is present.

21.  a  khəŋləm  b. ləmlən
    khəŋ-lem  ləmlən
    noun-noun  noun-verb
    leg-path  path-straight
    'footpath'  'straight road'

4.1.5 Lateral deletion

          The lateral ɬ deletes after the voiceless velar stop k. This process is
          formalized in R5.

R5: [+ lateral]  \(\rightarrow\)  \(\emptyset\)

          \[ -\) anterior \\
          - coronal \\
          - spread glottis \\
          - voice \]
The Lateral Deletion rule applies with the affixation of the perfect aspect marker -1ə̚, the progressive aspect marker -1i or the derivational marker -1ə̚m as illustrated in example 22. A rule subsequently applies to intervocalic k to change it to glottal stop (see the rule of k to Glottal Stop).

22. a. yoʔe̚be̚b  b. puʔe̚ibe̚b  c. laʔe̚mni
   yok-1ə̚-pe̚  pu-lə̚k-li-pe̚  lak-1ə̚m-1i
   verb-vinf/inf  verb-vderu-vinf/inf  verb-vderu-vinf
   rear-perf-inf  carry-dsource-prog-inf  come-seq-prog
   'rear up'      'coming'             'carried here'

However, note that the Lateral Deletion rule does not apply when the derivational morpheme -1ə̚k 'come and do something' is suffixed to a verb stem ending with the derivational suffix -tʰok. This is illustrated in example 23(a,b) where the initial 1 of the derivational suffix -1ə̚k does not delete but becomes r in intervocalic position (see the Trilling rule) after the final k of the derivational suffix -tʰok deletes (see the Velar Deletion rule). As illustrated in example 23b, the initial 1 of -1ə̚ does delete under the influence of the preceding k of -1ə̚k. Note in 23(a,b), the additional application of the k to Glottal Stop rule (R8) which changes the intervocalic k of -1ə̚k to a glottal stop and the application of the Trilling rule (R3) which changes intervocalic 1 to r.

23. a. puθore̚i  b. coθhore̚e̚g
   pu-tho-1ə̚k-i  co-thok-1ə̚k-1e̚
   verb-vderu-vderu-vinf  verb-vderu-vderu-vinf/inf
   carry-out-dsource-pres  jump-out-dsource-perf-ass
   'carries out'           'jumping out'

4.1.6 Velar stop deletion

A rule applies to delete voiceless velar stops before laterals. This process is formalized in R6.

R6: [  - anterior
       - coronal
       - spread glottis
       - voice ]   --> θ  /
               [ + lateral ]

Example 24(a,b) illustrates the application of the Velar Deletion rule where the k of -tʰok is deleted with the suffixation of the directional suffix
-lək. After the application of the Velar Deletion rule, the Trilling rule (R3) applies in 24(a,b) and the k to Glottal Stop rule (R8) applies in 24b.

24. a thọrəkpe thok-1ək-pə out-dsource-inf ‘came out’ b. puthọreʔu pu-thok-1ək-u carry-out-dsource-imp ‘carry out’

However, the Velar Deletion rule does not apply when the perfect marker -lə is suffixed to the derivational suffix -thok. This is illustrated in example 25a where the the Lateral Deletion rule applies, deleting the l which occurs after the k. k subsequently becomes a glottal stop (see R8). As illustrated in 25(b-d), the Velar Deletion rule also does not apply in some compounds.

25. a khoktoʔe b. thoklakpe c. caklem d. khikløy
khok-thok-1ə-e thok-lak-pə cak-lem khik-loy
verb-verb-inf-enc verb-verb-inf noun-verb noun-noun
peel-out-perf-exper happen-come-inf rice-remain thatch-bamboo
‘peeled off’ ‘to emerge’ ‘left over rice’ ‘bamboo thatch’

Consider the necessary ordering between the rules of Lateral Deletion and Velar Deletion. In the derivation of a form like conθhoreʔe ‘jumped out’ (see 23b for gloss of morphemes), if Lateral Deletion is assumed to apply before Velar Deletion, the incorrect form given in 26a is derived. If the Velar Deletion is assumed to apply before Lateral Deletion, the incorrect form given in 26b is derived.

26. a /con-thok-1ək-1ə/ con-thok-ək-ə
Lateral Deletion applies
environment for Velar Deletion no longer available

b. /con-thok-1ək-1ə/ con-tho-1ə-1ə
Velar Deletion applies
environment for Lateral Deletion no longer available

Thus mere ordering of the Lateral Deletion rule before the Velar Deletion rule or ordering of the Velar Deletion rule before the Lateral Deletion rule will not yield the correct result. However, both rules do apply to the form. Thus, the formalism used to characterize the application of these rules must be able to insure that the Velar Deletion rule applies with the affixation of -lək but is “turned off” with the affixation of -lə.
Furthermore, the Lateral Deletion rule must not be allowed to apply until after the affixation of \(-l\,\vartheta\,k\) and the application of the Velar Deletion rule. The Lateral Deletion rule must be "turned on" only with the affixation of \(-l\,\vartheta\,k\). In section 3.2, I will discuss a formalism that can characterize these facts about the rules of Lateral Deletion and Velar Deletion.

4.1.7 Gemination\(^{12}\)

A rule applies to geminate syllable-final consonants that are followed by a vowel. This rule is formalized in R7.

\[ R7: \emptyset \longrightarrow [ + \text{consonantal} \quad - \text{spread glottis} \\
\beta \text{ coronal} \\
\gamma \text{ anterior} \\
\beta \text{ Feature}_5 \\
\gamma \text{ Feature}_6 ] / [ + \text{consonantal} \quad - \text{spread glottis} \\
\beta \text{ coronal} \\
\gamma \text{ anterior} \\
\beta \text{ Feature}_5 \\
\gamma \text{ Feature}_6 ] \cdot V \]

The Gemination rule applies when the present tense marker \(-i\) (see example 27(a-d)), the imperative marker \(-u\) (see example 27(e-f)), or the experiential evidential enclitic \(-\vartheta\) which gives the meaning 'I saw X happen' (27g) is suffixed to a verbal root ending in a consonant.

27. a. cel 'run' celli 'runs'
   b. kəp 'cry' kəppi 'cries'
   c. cəŋ 'enter' cəŋŋi 'enters'
   d. ləy 'be' ləyyi 'is'
   e. thəm 'keep' thəmmu 'keeps'
   f. yeŋ 'look' yeŋŋu 'looks'
   g. thəm 'keep' thəmmə 'keeps'

\(^{12}\) Nonlexical expressive gemination may also be employed to give emphasis to the form in which it occurs, as shown in the examples given below.

a. nəmənay b. issəy c. əŋəŋəpəni d. i-buŋən
   nə-nənay i-əŋy ə-ŋəŋ-ə-ni i-buŋ-o
   2PP-servant 1PP-self att-strange-inf-cop 1PP-master-voc
   'your servant' 'ourselves' 'be strange' 'my master'
Note that the Gemination Rule applies in the same environment as the rule of Voicing Assimilation. Thus if the Gemination rule applies first, the Voicing Assimilation rule cannot apply, and if the Voicing Assimilation rule applies first, the Gemination rule cannot apply. In order to assure that these two rules do not bleed each other, I have encoded in the formalization of the rule the observation that the Gemination rule applies to syllable final consonants whereas the Voicing Assimilation rule applies to syllable initial consonants.

4.1.8 *k* to Glottal Stop

Although the Gemination Rule indicates that *k* also geminates intervocally, geminate *k* clusters are not attested on the surface. Instead, in those environments where a *kk* cluster is expected, a glottal stop appears. For instance, in example 28a when the present tense morpheme *−i* is suffixed to *−lək* ‘come and do something’, in example 28b when the imperative marker *−u* is suffixed to the stem *pɨhək*, and in example 28c when the experiential enclitic *−e* is suffixed to the verb *tʰək*, *k* appears as a glottal stop and not as a geminate.

28. a. *həl̥e?i*  
   verb-uderu-verb  
   return-dsource-pres  
   'returns'  

   b. *pɨθəʔu*  
   verb-verb-verb  
   give-drink-imp  
   'give to drink'  

   c. *θəʔe*  
   verb-enc  
   drink-exper  
   'drink (I know you)'

Consider a possible formulation for capturing this distribution of glottal stop. Suppose that intervocalic *k* does geminate by the Gemination Rule, but that it is subsequently reduced to a glottal stop as formalized in

\[
R^*: \left[ \begin{array}{c} \text{anterior} \\ \text{coronal} \\ \text{spread glottis} \\ \text{voice} \end{array} \right] \rightarrow \left[ \begin{array}{c} \text{anterior} \\ \text{coronal} \\ \text{spread glottis} \\ \text{voice} \end{array} \right]_{\text{consonantal}} \rightarrow \left[ \begin{array}{c} \text{consonantal} \\ \text{sonorant} \\ \beta \text{ Feature}_3 \\ \gamma \text{ Feature}_4 \end{array} \right]_{\text{V} \_ \_ \_ \text{V}}
\]

An advantage of postulating that the intervocalic glottal stop in 28(a-c) is derived from geminate *k* is that a general statement can be made that all unaspirated consonants geminate with the suffixation of the verb inflectional

---

13 The relevant features for glottal stop are [- sonorant] and [- consonantal].
morphemes -i and -u and with the enclitic -e. However, the rule which changes kk to glottal stop as formulated in R* is inelegant for two reasons. First, it makes it necessary for the effect of the Gemination Rule to be undone before it can apply. That is, R* implies that k -- k by the Gemination Rule and then k k -- k by R* Again, R* does not explain which of the segments in a kk sequence gets deleted and which gets changed to glottal stop. Also, R* incorrectly predicts that k k sequences will never appear on the surface. kk sequences are attested in forms such as kʰi[kkət (example 6c) where the kk sequence is not followed by the inflectional morphemes -i, -u or by the enclitic -e. These observations suggest that the Gemination Rule does not apply to intervocalic k and that intervocalic k changes to glottal stop before the application of the Gemination Rule.

For these reasons, I will adopt the analysis that intervocalic k, in the relevant morphological environment, is changed to glottal stop before the application of the Gemination rule. The process which changes k to glottal stop is formalized in R8.

\[
\begin{align*}
\text{R8:} & \quad ~ \begin{bmatrix}
\text{anterior} \\
\text{coronal} \\
\text{spread glottis} \\
\text{voice}
\end{bmatrix} \quad \rightarrow \quad \begin{bmatrix}
\text{- consonantal} \\
\text{- sonorant} \\
\ul{\text{β Feature}}_3 \\
\ul{\text{γ Feature}}_4
\end{bmatrix} \\
\end{align*}
\]

Note that the application of the rule of k to Glottal Stop followed by the Gemination rule will also correctly allow for the derivation of the kk sequence in kʰ i[kkət.

4.1.9. Glottal stop insertion

A glottal stop is inserted between adjacent vowels as formalized in R9. R9 applies to sequences of the form V_iV_j where i=j.\(^{14}\)

\(^{14}\) A \(V_iV_i\) becomes \(V_i\).
The application of the Glottal Stop Insertion rule is illustrated in example 29(a-c), where the prefixation of \( mə- \) 'method of doing V', on a stem beginning with a vowel, results in the insertion of a glottal stop between the prefix and stem.

29. a. ut 'show' \( mə?ut \) 'method of showing'  
b. i 'write' \( mə?i \) 'method of writing'  
c. in 'feed' \( mə?in \) 'method of feeding'

However, the Glottal Stop Insertion rule does not apply between words even when the environment for the rule is met. This is illustrated in example 30(a,b).

30. a. \( məmə\ əsînə \)  
\( mə-ma\ ə-si-nə \)  
3PP-mother \( uðeru-pdet-foc \)  
'his mother'  
b. \( ə\ əsî \)  
\( ə\ ə-si \)  
\( fish\ əðeru-pdet \)  
'this fish'

Also, Glottal Stop Insertion does not apply in the morphological environments given in section 3.1.10, where instead of a glottal stop being inserted, a diphthong is created.

4.1.10 Diphthongization

A rule applies creating a diphthong from a vowel sequence of the form \( V_1V_j \) where \( i=j \). This process is formalized in R10.

R10: \( V_j \rightarrow [-\text{syllabic}] / V_1 \rightarrow V_j \)

As illustrated in example 31, the Diphthongization rule applies when the present tense suffix \(-i\) (as in 31 (a-c)) or when the imperative marker \(-u\) (as in 31d-f) is added to a root ending in a vowel.
31. a u 'see' uy 'sees'  
b. pa 'hold' pay 'holds'  
c. cə 'scold' cəy 'scolds'  
d. thə 'plant' thəw 'plants'  
e. ca 'eat' caw 'eats'  
f. pa 'read' paw 'reads'  

The Diphthongization rule also applies when the present tense marker  
-ı is suffixed to a derivational suffix ending with a vowel such as:  -ıə  
'action takes place towards the speaker' (see example 32a):  -ıu 'action  
takes place away from the speaker' (see example 32b).

32. a phərəy  
phə-ıə-ı  
verb-vderv-vinfl  
good-adir-pres  
'came here and  
is good'  
b. phərəy  
phə-łu-ı  
verb-vderv-vinfl  
good-tdir-pres  
'went there and  
is good'

However, the Diphthongization rule does not apply in the  
morphological environments where the Glottal Stop Insertion rule applies.

Consider the ordering of the Glottal Stop Insertion rule and the  
Diphthongization rule which apply in the same phonological environment  
(intervocalic). The application of the Glottal Stop Insertion rule bleeds the  
Diphthongization rule and the application of the Diphthongization rule  
bleeds the Glottal Stop Insertion rule. This is illustrated in 33: in 33a,  
where the Glottal Stop Insertion rule applies on -u and -ı affixation, i. and  
ii. are incorrectly derived; in 33b, where the Diphthongization rule applies  
on -ıə affixation, iii. is incorrectly derived.

33. a  

i. ii. iii.  
V-u V-i mə-V  
*V?u *V?i mə?V  
Glottal Stop Insertion applies  
the environment for Diphthongization is  
no longer available

b.  

i. ii. iii.  
V-u V-i mə-V  
Vv Vv  
*əəy/əəv  
Diphthongization applies  
the environment for Glottal Stop  
Insertion is no longer available
Thus mere ordering of the Glottal Stop Insertion rule before the Diphthongization rule or ordering the Diphthongization rule before the Glottal Stop Insertion rule will not derive the correct result. The formalism used to characterize the application of these rules must be able to insure that the Glottal Stop Insertion rule applies only with the affixation of -$\emptyset$- and that the Diphthongization rule applies only with the affixation of -i and -u. In section 3.2, I will discuss a formalism that can isolate the application of these rules to the specific morphological environment where they must apply.

4.1.11  $\emptyset$ Deletion

A rule exists deleting morpheme final $\emptyset$ as formalized in R11.

\[
R11: \begin{cases}
+ \text{syllabic} \\
- \text{back} \\
- \text{tense}
\end{cases} \rightarrow \emptyset / + X
\]

R11 applies with the affixation of the nonhypothetical enclitic -i, which gives the meaning 'this is the way it is' or the experiential evidential enclitic -e which gives the meaning 'I saw X happen'. This is illustrated in example 34(a,b).

34. a cin-silli 
b. tak-$\emptyset$are
   cin-sil-l$\emptyset$-i 
   ta-k$\emptyset$are-l$\emptyset$-e
   verb-noun-verb-vinfl-enc 
   verb-vinfl-verb-vinfl-enc
   drag-in-perf-nhyp 
   fall-infr-perf-exper
   'dragged in' 
   'all fell'

Note that in example 34, even though the structural descriptions of Diphthongization (R10) and Glottal Stop Insertion (R9) are met, neither rule applies. Thus a formalism which is to capture the interaction of R9, R10 and R11 must insure that R9 and R10 do not apply when the morphological environment for $\emptyset$ Deletion is available. Also, $\emptyset$ Deletion must not be able to apply in the morphological environments where R9 and R10 apply.

The rule of $\emptyset$ Deletion applies when the negative morpheme -t$\emptyset$ (35a,b), the factive marker -$p$ (35c), the irrealis marker -t$\emptyset$ (35d), or the past perfect aspect marker -$k^h$ (35e) is followed by I. Note in each case the additional application, where possible, of the Voicing Assimilation rule and the Trilling rule.
35. a. phudrinṛṇay
   phu-te-li-yay
   verb-vinfl-vinfl-uderu
   beat-neg-prog-during
   'not during beating'

b. kʰəndrebə
   kʰən-te-lə-pə
   verb-vinfl-vinfl-vinfl
   know-neg-perf-inf
   'not know'

c. phubra
   phu-pə-la
   verb-vinfl-vinfl
   beat-fac-pint
   'did beat?'

d. phudra
   phu-te-la
   verb-vinfl-vinfl
   beat-irr-pint
   'did beat?'

e. takhreb
   ta-kʰə-lə-e
   verb-vinfl-vinfl-enc
   fall-perf-perf-exper
   'already had fallen'

The rule of θ Deletion does not apply in the majority of the available morphological environments. First, θ Deletion does not apply in sequences of morphemes which occur after verb stems and act as clausal subordinators. This is illustrated in example 36(a-b) with the quotative verb\textsuperscript{15} stem 'say' which is commonly used as a complementizer. Note the application of the Voicing Assimilation rule in 36(a-b) and the application of the Trilling rule in 36a.

36. a. hayrege
   hay-le-ke
   say-perf-ass
   'afterwards'

b. haybeside
   hay-pəsi-te
   say-inf-pdet-dat
   'therefore'

Second, θ Deletion also does not apply to the third person possessive prefix -mə or the attributive marker ø-. As illustrated in example 37(a,b), θ does not delete after affixation of the prefix.

37. a. mərup
   me-rup
   3PP-friend
   'friend'

b. øəkəpəni
   øə-ŋək-pə-ni
   att-strange-inf-cop
   'be strange'

Finally, as illustrated in example 38, θ Deletion does not apply across word boundaries.

\textsuperscript{15} Some morphemes in the verb morphology have been analyzed as being case markers. This is indicative of a syncretism of case postpositions and clausal coordinators and subordinators in Manipuri. Genetti (1986) shows the syncretism of case postpositions and clausal subordinators in 18 languages of the Bodic branch of the Tibeto-Burman family, including Tibetan.
4.2 Phonological evidence for level-ordering

4.2.0 Introduction

In section 4.1, I have attempted to illustrate that there are phonological rules in Manipuri which apply in certain morphological environments but fail to apply in others. Additionally, it has been seen that certain rules need to be ordered with respect to each other: the Deaspiration rule must apply before the Voicing Assimilation rule, and the k to Glottal Stop rule must apply before the Gemination rule. It has also been shown that there are certain cases, as in the interaction of the Lateral Deletion rule and the Velar Deletion rule, where both rule ordering and the morphological environment must be specified for a correct characterization of the interaction of the rules. In section 3.2, it will be seen that these facts can be derived as a natural consequence of the framework of LP without the incorporation of a large amount of morphological information in the phonological rule writing formalism.

4.2.1 The framework of Standard LP

Following standard LP format (Kiparsky, 1982), it will be assumed that word formation and phonological processes are organized in hierarchically ordered levels (L) as illustrated in Figure 5. As shown in Figure 5, underven lexical items feed into L1 phonology. L1 phonology feeds into L1 morphology. The arrows from L1 phonology to L1 morphology and from L1 morphology to L1 phonology indicate that rules apply recursively within that level of the Lexicon. As indicated by the arrows, rules also apply recursively at L2 and L3. Phonological rules which apply at a given level are scanned for applicability each time a form is created by word formation processes. The output of L1 feeds into L2, the output of L2 feeds into L3 and the output of L3 feeds into the syntax which in turn feeds into the postlexical phonological component. Phonological rules of L1 apply only to forms created at L1; L1 phonology is turned off after L1. Since the output of L1 is fed into L2, the phonological rules of L2 apply to forms created at L1, as well as to those created at L2. Also, the phonological rules of L2 do not apply
after L2. Since the output of L2 is fed into L3, the phonological rules of L3 apply to forms created at L1, L2 and L3. However, L3 phonological rules apply only at L3 and are inoperative at the postlexical level.

**Figure 5: The lexicon**

Phonological rules which take place at the postlexical level are distinct from lexical phonological rules in that they do not make reference to word-internal structure and are not morphologically conditioned. Thus, post-lexical rules apply across the board and are exceptionless. Furthermore, as no morphological processes take place postlexically, post-lexical rules do not apply cyclically. This is indicated by the arrows in Figure 5.

### 4.2.2 Blocking rule application in a given morphological environment

LP theory can characterize the observation made in section 4.1 that there are phonological rules in Manipuri which apply in certain morphological environments but fail to apply in others. The relevant information is summarized in Figure 6, and the ordering in compounds is dealt with in section 4.2.6.
**Figure 6: A summary of the interaction between the morphology and phonology**

<table>
<thead>
<tr>
<th>Phonological Rule</th>
<th>Applies with the affixation of these morphemes</th>
<th>Does not apply with the affixation of these morphemes</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1 Voicing Assimilation</td>
<td>infinitive -pə; case markers; some compounds; -thok, -kʰət</td>
<td>pprefix -i, mə; attributive prefix ə-; derivation V→N, mə-; some compounds; borrowed words</td>
</tr>
<tr>
<td>R2 Deaspiration</td>
<td>-thok, -kʰət; some compounds</td>
<td>some compounds</td>
</tr>
<tr>
<td>R3 Trilling</td>
<td>pronominal prefix i-, mə-; attributive prefix ə-: aspect markers -lə, -li; directional markers -lə, -lu, -lək, -ləm; some compounds</td>
<td>between words; some compounds</td>
</tr>
<tr>
<td>R4 Total Assimilation of l</td>
<td>directional markers -lə, -lu, -lək, -ləm: aspect markers -lə, -li; negative future -loy</td>
<td>some compounds</td>
</tr>
<tr>
<td>R5 Lateral Deletion</td>
<td>aspect markers -lə, -li</td>
<td>directional -lək</td>
</tr>
<tr>
<td>R6 Velar Stop Deletion</td>
<td>directional -lək</td>
<td>aspect -lə; some compounds</td>
</tr>
<tr>
<td>R7 Gemination</td>
<td>verb inflection -i, -u; vocative -o; enclitic -i, -e</td>
<td></td>
</tr>
</tbody>
</table>
Consider first the case of Voicing Assimilation (R1). It was noted that R1 does apply with cases of suffixion but does not apply with cases of prefixation. In LP theory, this fact can be captured by placing the morphological environments where Voicing Assimilation applies on an earlier level than the environments where the rule fails to apply, and by pairing the Voicing Assimilation rule with the earlier level. This level-ordering is shown in 39.

39.

<table>
<thead>
<tr>
<th>Level</th>
<th>Morphology</th>
<th>Phonology</th>
</tr>
</thead>
<tbody>
<tr>
<td>earlier</td>
<td>suffixation</td>
<td>Voicing Assimilation</td>
</tr>
<tr>
<td>later</td>
<td>prefixation</td>
<td>later level phonology</td>
</tr>
</tbody>
</table>

R8 k to Glottal Stop
verb inflection -i, -u;
vocative -ο;
enclitic -i, -ε

R9 Glottal Stop Insertion
derivational V → N, m espresso between words;
imperative -u;
tense -i

R10 Diphthongization
imperative -u;
tense -i
derivation V → N, -m espresso;
imperative -u;
tense -i;
clausal subordinators -rε, -beside;
attributive -ε;
prefix m espresso;
between words

R11 θ Deletion
enclitic -i, -ε;
negative -tε followed by -rε; polarity
interrogative -ra;
past perfect -kθε
derivation V → N, m espresso
This level-ordering assures that the application of the Voicing Assimilation rule is restricted to the earlier level where suffixation takes place. The Voicing Assimilation rule will not apply at the later level where prefixation takes place, since it is turned off at the end of its own level of application. In this way, the application of the rule to morphological environments created at the later level is blocked. A similar treatment of the morphological environment where the rule of Deaspiration does or does not apply can be used to characterize the (non)application of the rule. The fact that the Deaspiration rule must apply before the Voicing Assimilation rule can also be derived by allowing for the application of the Deaspiration rule at the level where the Voicing Assimilation rule applies. It would also be possible to allow the Deaspiration rule to apply before the application of the Voicing Assimilation rule. For instance, if the Deaspiration rule applied at L1 and the Voicing Assimilation rule applied at L2, the forms to which the Deaspiration rule applies would also undergo the Voicing Assimilation rule, since the output of L1 is fed into L2 and undergoes all L2 rules. A more definite statement about the level-ordering of the Voicing Assimilation and Deaspiration is given in section 4.2.3, where the interaction of these rules with the rules of Lateral and Velar Deletion is taken into consideration.

4.2.3 Linear order of morphemes

Recall now the case of the Lateral Deletion rule and the Velar Deletion rule. In this instance, both rule ordering and the morphological environment must be specified for a correct characterization of the way they interact. Such a characterization is made possible in LP theory. Recall that Lateral Deletion applies with the suffixation of the aspect markers -lɪ and -lə and the directionals -lə, -lu and -ləm while the Velar Deletion rule applies with the suffixation of -lək. In order to make certain that Lateral Deletion does not apply with the suffixation of -lək, the rule can be paired with the affixation of the specified aspectual and directional markers at a level different from that of -lə affixation. Similarly, in order to avoid the application of Velar Deletion to the aspectual and directional markers to which Lateral Deletion applies, Velar Deletion can be paired with the affixation of -lək at a different level from the application of Lateral Deletion.

---

16 It is usually claimed that lexical rules are structure preserving: that is, in the course of lexical derivations they do not introduce segments that are not present in the underlying segment inventory of a language. However, in the Manipuri data we see that VAR, which is clearly a lexical rule, is not structure preserving, since it introduces voiced stops which are not phonemic in Manipuri.
Since the level-ordered lexicon reflects the order in which morphemes are concatenated, an additional way to determine the level-ordering of -1ək and -1ə affixation, is to consider the linear order of these morphemes. In a form like conthore?əge (see example 23b for gloss of morphemes) it is clear that -1ək affixation occurs before the affixation of -1ə. Thus, -1ək affixation is assumed to occur, along with the application of the Velar Deletion rule, at a level before the affixation of -1ə.

A derivation which illustrates the application of the Lateral Deletion rule and the Velar Deletion rule with this level-ordering is given in 40.

40. earlier          con-thok-1ək  Velar Deletion applies
    level             contholek

later             contholek-1ə          Lateral Deletion applies
    level             contholekə

further morphology and phonology [conthore?əge]

The level-ordering of the rules of Voicing Assimilation, Deaspiration, Lateral Deletion and Velar Deletion can now be determined. First, in the linear order of morphemes given in 41, -1ə is affixed before the L2 infinitive marker (41a) and before the L2 associative marker (41b).

41. a carəbedi        b. carege
    ca-lə-pə-ti    ca-lə-kə
    eat-perf-inf-ex     eat-perf-ass
    'if (l) eat'        'after eating'

Thus -1ə must occur before the affixation of the infinitive and associative marker. Furthermore, these markers undergo the Voicing Assimilation rule. Thus Voicing Assimilation can occur at the same level as Lateral Deletion. Also, as shown in the form conthore?əge, -1ək is affixed after the derivational marker -thok in the linear order. Since -1ək must be affixed before the affixation of -ə, I will assume that -thok (also -kət) as well as -1ək are affixed at a level before the affixation of -1ə. Finally, as shown in 39, Voicing Assimilation is blocked from applying with prefixation by allowing prefixation to occur after the application of the Voicing Assimilation rule. Based on these facts about the interaction of morphological and phonological processes, I will adopt the level-ordering given in 42.
As was noted in section 4.1.10, the rules of Diphthongization and Glottal Stop Insertion apply to the same phonological environment. However, the correct surface forms can be derived only if the application of Diphthongization is restricted to \(-i\) and \(-u\) suffixed forms and the application of the Glottal Stop Insertion rule is restricted to \(mə\)- affixed forms. This effect can be derived by affixing \(-i\) and \(-u\) at a different level from \(mə\). If the rule of Diphthongization is applied at the same level as \(-i\) and \(-u\) affixation and the rule of Glottal Stop Insertion is applied at the same level as \(mə\)- affixation, the two rules will not be able to bleed each other.

Again, the linear order of morphemes can be used to determine if \(mə\)- affixation should occur at a level earlier or later than \(-i\) and \(-u\) affixation. Consider a form like \(cərəp\) 'has eaten' from \(cə\) 'eat', \(-lə\) perfect aspect, \(-i\) 'present tense', where \(-i\) follows the L2 marker \(-lə\). This indicates that \(-i\) must be affixed either at L2 or L3. However, according to the level-ordering set up in 42, prefixation, which includes the affixation of \(mə\)-, takes place at L3. Thus \(-i\) and \(-u\) affixation must take place at L2. So, Diphthongization is an L2 rule, Glottal Stop Insertion is an L3 rule and the level-ordering shown in 43 is obtained.
4.2.4 Trilling and Total Assimilation of \( l \)

Recall that the Trilling rule and the Total Assimilation of \( 1 \) rule, apply with both the L1 affixation of \( -l \partial k \) and the L2 affixation of the directional suffixes \( -l \partial, -l u \) and \( -l \partial m \), the aspect markers \( -l i, -l \partial, \) and the negative future marker \( -l o y \). So that these rules can apply to forms created at L1 and L2, they may apply at L2 since the output of L1 feeds into L2. The rules may also apply at L3 since the output of L1 and L2 feeds into L3. An L3 ordering of the Trilling rule will correctly predict the application of the rule with the affixation of L3 pronominal prefixes, \( i-, m \partial-, \) the derivational prefix \( m \partial- \), and the attributive prefix \( \partial- \). For these reasons, I will assume that the Trilling rule applies at L3. However, I will assume that the rule of Total Assimilation of \( 1 \) applies at L2 in order to allow for the formation of compounds at L3 to which this rule does not apply. See section 4.2.6 for further discussion of compounds.

4.2.5 Post-lexical and enclitic phonology

4.2.5.1 \( \partial \) Deletion

Consider now the ordering of the \( \partial \) Deletion rule (R11). I will assume that the application of the rule with enclitics is part of the enclitic phonology of the language. This rule of enclitic phonology has the form given in 3.1.11. In 44, the derivation of \(-\partial \) 'dragged in' (see 34a for a gloss of morphemes) is given showing the application of the rule of \( \partial \) Deletion after the affixation of the enclitic \(-l\).

44. L2 cin-sil-\( l \partial \)

   enclitic cinsil\( \partial \)i - \( \partial \) Deletion applies
   phonology [cinsi\( \partial \)l]i

Recall that \( -\partial \) also deletes in the sequences \( t \partial-1i \) 'negative + progressive', \( t \partial-1 \partial \) 'negative + perfect', \( p \partial-1 \partial \) 'factive + yes-no interrogative', \( t \partial-1 \partial \) 'irrealis + polarity interrogative' and \( k^{h} \partial-1 \partial \) 'past perfect + perfect'. In each of these cases, \( -\partial \) deletion cannot apply until after the trilling of \( 1 \) in intervocalic position and the voicing of \( t \) and \( p \) in the case of the negative, factive and irrealis markers. Thus \( -\partial \) Deletion must be level-ordered after the application of the Voicing Assimilation rule and the Trilling rule.
However, note that the rule does not apply to forms like hayrege (36a), which has undergone the Voicing Assimilation rule and the Trilling rule. However, if the -ə Deletion rule is ordered in the lexical phonology, after the Voicing Assimilation rule and the Trilling rule, the form hayrege should undergo -ə Deletion. Thus, if -ə Deletion is thought of as a lexical rule there is a problem in deriving the correct level-ordering for the forms in 36(a,b).

In fact, it appears that the correct analysis of this rule is that it is a post-lexical rule, applying to make forms conform to a restriction in the language against sequences such as those given in 45, by deleting the final-ə of the first morpheme in the sequence.

45. \{p, ph, b, t, th, d, k, kh, g\} are

This post-lexical rule, which I will refer to as 11a, will have the form given in 46.

46. R11a: [+ syllabic] - back - tense \[→ \] [\[ - sonorant \[ β coronal \[ γ anterior \[ + sonorant \[ + coronal \[ - anterior \]

4.2.5.2 Gemination and k to Glottal Stop

Consider the level-ordering of the Gemination rule and the k to Glottal Stop Rule. Recall that the rule of k to Glottal Stop must precede the application of the Gemination rule. Thus the rule of k to Glottal Stop will be ordered before the Gemination rule. Second, as these rules are exceptionless, that is there are no lexical environments where the rules do not apply. I will assume that they are post-lexical rules.

4.2.6 Level-ordering and compounding

As was illustrated in 3.1, in the formation of certain compounds, phonological rules of the grammar may apply or fail to apply. On this phonological evidence, it is possible to postulate the levels at which the compounds under discussion are formed.
4.2.6.1 Lexically formed compounds

The compounds that undergo the L1 rule of Deaspiration (12a-c) and subsequently the L2 rule of Voicing Assimilation are assumed to be formed at L1. After the application of Deaspiration on these forms at L1, they will be fed into L2 phonology where the Voicing Assimilation rule will apply to them. Those compounds that undergo the L2 rule of Voicing Assimilation (5a-d) are postulated as being formed at L2.

Compounds like k\text{h}ο\text{η}λ\text{ω}m and l\text{ω}m\text{i}οn (21a,b) to which the L2 rule of Total Assimilation of l does not apply are assumed to form at L3. Since the rule of Total Assimilation of l will be turned off after L2, the rule will be blocked from applying to compounds formed at L3. Other compounds which do not undergo L1 or L2 rules are postulated as being formed at L3. This set includes the compounds (8a-f) to which the Voicing Assimilation rule and the Deaspiration Rule (13a-c) do not apply.

Finally, consider the formation of the compounds t\text{h}ο\text{k}λ\text{α}κ\text{π}e, c\text{a}k\text{l}εm and k\text{h}ικ\text{k}loy (25b-d). The L1 rule of Velar Deletion and the L2 rule of Lateral Deletion do not apply to these compounds. This indicates that these compounds cannot be formed at L1 or L2. Thus it is assumed that they are formed at L3.

Finally, since the compound v\text{a}ri\text{l}i\text{b}e does not undergo the L3 rule of Trilling, it is assumed to be formed post-lexically from the lexically formed noun v\text{a}ri 'story' and verb infinitive verb l\text{i}b\text{e} 'to tell'.

4.2.6.2 Classifying compounds

At this point, I am uncertain as to how to classify the compounds formed at each level. Certainly, the differences among L1, L2 and L3 compounds are not based on differing degrees of semantic productivity: compounds from L2 or L3 can be said to be semantically transparent (where the meaning of the whole is derivable from a sum of the meanings of the individual morphemes). For instance: the L2 compound u\text{n}b\text{a}nt\text{h}\text{a} 'winter' is derived from the stems for ice, rule and month; and the L3 compound k\text{h}ικ\text{k}lo\text{y} 'bamboo thatch' is derived from the stems for thatch and bamboo. A second possibility for characterizing the compounds may be that: L3 compounds are those where the initial stem is used as a prefix and all other compounds are formed at L2. A final possibility is that L2 and L3 compounds differ with regard to suprasegmental features. Further research will have to be conducted before more can be said on this point, as I have yet
to investigate this possibility in my data and little information on this topic is available in the literature.\textsuperscript{17}

4.2.7 Morpheme type and phonological rule type

Given these facts about the ordering of R1-R11, the level-ordering of morphological and phonological rules will be as shown in Figure 7. The generalization to be drawn about level of affixation and class of morpheme is given in 47.

47. L1 special verb derivation

L2 regular derivation and inflection compounding

L3 derivational and inflectional prefixation

Level-ordering highlights the parallel between the early application of the most specific phonological rules with the most restricted morphological environments and the late occurrence of the most generally applicable phonological rules with the most productive morphological processes.

\textsuperscript{17} See Chelliah (in press) for more on the level-ordering of compounds.
Figure 7: Level ordering of morphological and phonological rules

<p>|</p>
<table>
<thead>
<tr>
<th>Level</th>
<th>Morphology</th>
<th>Phonology</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>vderv -lək</td>
<td>R6</td>
</tr>
<tr>
<td></td>
<td>-tʰək, -kʰət</td>
<td>R2</td>
</tr>
<tr>
<td>L2</td>
<td>infinitive -pə</td>
<td>R1</td>
</tr>
<tr>
<td></td>
<td>case markers</td>
<td>R4</td>
</tr>
<tr>
<td></td>
<td>vinf -u, -i</td>
<td>R5</td>
</tr>
<tr>
<td></td>
<td>aspect -lə, -li</td>
<td>R10</td>
</tr>
<tr>
<td></td>
<td>directionals -lə, -lu, -ləm</td>
<td></td>
</tr>
<tr>
<td>L3</td>
<td>pprefix i-, mə-</td>
<td>R9</td>
</tr>
<tr>
<td></td>
<td>att prefix e-</td>
<td>R3</td>
</tr>
<tr>
<td></td>
<td>deriv V → N, -mə</td>
<td></td>
</tr>
<tr>
<td>enclitic phonology</td>
<td>enc -ə, -i</td>
<td>R11</td>
</tr>
<tr>
<td>post-lexical phonology</td>
<td>automatic rules, apply in all environments</td>
<td>R11a, R7, R8</td>
</tr>
</tbody>
</table>

Note, however, that the morphological processes at each level cannot be characterized in terms of inflectional as opposed to derivational affixation as is the case for English (Kiparsky, 1982). The relevant distinction for the lexical phonology of Manipuri is between suffixation (L1 and L2) and prefixation (L3).
5.0 Conclusion

In this paper, I have presented a number of phonological rules in Manipuri and shown how their (non) application may only be characterized by making reference to morphological information. It was also shown that because of the bleeding relationship obtaining between certain rules (R5 and R6), the mere ordering of rules will not give the correct forms. Finally, it was shown that the representation of the Manipuri facts in the theory of LP, where concatenation of morphemes and phonological processes occur side by side in hierarchically ordered levels, allows for the correct and elegant characterization of phonological and morphological processes in Manipuri.
# LIST OF MORPHEMES AND ABBREVIATION CONVENTIONS

1. Abbreviations used in glosses of examples

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>adir</td>
<td>action takes place away from the speaker</td>
<td>-lu</td>
<td></td>
</tr>
<tr>
<td>acc</td>
<td>accusative</td>
<td>-pu</td>
<td></td>
</tr>
<tr>
<td>agen</td>
<td>agentive</td>
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<td>associative</td>
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<td>come and do something</td>
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<td>determiner signifying proximity</td>
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<td>-1ẽm</td>
<td></td>
</tr>
<tr>
<td>tdir</td>
<td>action takes place towards speaker</td>
<td>-lẽ</td>
<td></td>
</tr>
<tr>
<td>voc</td>
<td>vocative</td>
<td>-o</td>
<td></td>
</tr>
<tr>
<td>1PP</td>
<td>first person possessive</td>
<td>i-</td>
<td></td>
</tr>
<tr>
<td>2PP</td>
<td>second person possessive</td>
<td>nẽ-</td>
<td></td>
</tr>
<tr>
<td>3PP</td>
<td>third person possessive</td>
<td>mẽ-</td>
<td></td>
</tr>
</tbody>
</table>
2. Abbreviations used for glossing categories

casem case marker
cenc enclitic
nderv noun derivation
ninf noun inflection
vderiv verb derivation
vinf verb inflection
N noun
V verb
pprefix pronominal prefix

3. In the phonological rule formalism V is used as an abbreviation for vowel.

APPENDIX 1

Forms followed by "(PCT)" are taken from Thoudam (1989) where they were given as minimal pairs to establish the phonemic inventory of Manipuri.

1. Bilabial stops: p/pʰ

pæbe 'to read'
pʰæbe 'to catch'

2. Alveolar stops: t/tʰ

tæbe 'to hear'
tʰæbe 'to plant'

3. Velar stops: k/kʰ

kæbe 'to climb' (PCT)
kʰæbe 'to be bitter' (PCT)

4. Affricates: c/cʰ

çæbe 'to eat'
ciŋ 'hill'
çæbe [sæbe] 'to impress'
chèŋ [shiŋ] 'ginger'
5. Nasals: m/n/ŋ

*ma*  'bed bug'
*na*  'ear'
*ŋa*  'fish'

6. Semivowels: v/y

*wanbe*  'to be tall'
*yane*  'to be swift'

7. Laryngeal and lateral: h/l

*hanbe*  'to place, put'
*lanbe*  'to cross'

8. Vowels

(a) Initial position

*ibə*  'to write'
*ubə*  'to see'
*oibə*  'to be'
*ərembe*  'residue'
*arambay*  'plane'

(b) Medial Position

*kəŋ*  'aquatic plant'
*kaŋ*  'chariot'
*kuŋ*  'dense'
*koŋbe*  'fine' (verb)
*kəŋ*  'texture of food when mixed with sand'
*kʰik*  'sprinkle'

(c) Final Position

*pʰisabə*  'weaver (masculine)'
*pʰisabi*  'weaver' (feminine)'
*pʰisabu*  'to the weaver'
*cabra*  'did eat?'
*caɾe*  'ate'
*ibuŋo*  'O mistress'
*ibuŋgi*  'of the mistress'
APPENDIX 2

Instantiation of the tree formation rules given in 1(a-f). The rules are repeated here. On the trees, the letter assigned to the rule used to rewrite nonterminal categories is shown in parenthesis next to the category abbreviation. Examples have been chosen to represent the Manipuri words presented in this paper. Numbers given to the right of the tree indicate the example number of the word as given in the body of the paper.

a. \[W \rightarrow W_{enc}\]
b. \[W \rightarrow STEM \text{ (INFL)}\]
c. \[STEM \rightarrow STEM \text{ (suffix)}\]
d. \[STEM \rightarrow (prefix) \text{ ROOT}\]
e. \[ROOT \rightarrow \{\text{ROOT} \}_{\text{root}}\]
f. \[INFL \rightarrow \text{infl}_1, \text{infl}_2, \ldots \text{infl}_n\]

1. \[W(b)\]
   \[STEM(d) \quad INFL(f)\]
   \[ROOT(e) \quad \text{infl}_1 \quad p\hat{e}\]
   \[\text{root} \quad \text{ca}\]

2. \[W(b)\]
   \[STEM(c) \quad \text{suffix} \quad p\hat{e}\]
   \[ROOT(e) \quad \text{root} \quad \text{lam po}y\]

3. \[W(b)\]
   \[STEM(d)\]
   \[ROOT(e) \quad \text{root} \quad p\hat{a}\]
   \[\text{root} \quad \text{un} \quad \text{pan}\]

4. \[W(b)\]
   \[STEM(d)\]
   \[\text{root} \quad \text{root} \quad \text{kum cin}\]

5a. \[\text{(3a)}\]
5b. \[\text{(5b)}\]
5c. \[\text{(5c)}\]
5. W(b)
   STEM(c)
   STEM(d) suffix
   \ \ t'ok
   \ \ ROOT(e)
   root
   hi

6. W(b)
   STEM(d)
   \ \ prefix
   \ \ i
   \ \ root
   \ \ pa

(6a)

7. W(b)
   STEM(d)
   prefix
   mə
   \ \ ROOT(e)
   root
   ma
   INFL(f)
   \ \ infl₁
   \ \ kɪ
   (8f)

8. W(b)
   STEM(d)
   \ \ INFL(f)
   \ \ infl₁
   \ \ infl₂
   \ \ nə
   \ \ pa
   \ \ root
   \ \ pa
   \ \ min

məməgi
mə-mə-ki
3PP-mother-of
of his mother

9. W(a)
   W(b)
   enc
   e
   \ \ W(b)
   \ \ STEM(d)
   \ \ \ ROOT(e)
   \ \ \ root
   \ \ \ ca
   \ \ \ INFL(f)
   \ \ \ infl₁
   \ \ \ lə

(14a)
13.  
\[ \text{W(b)} \]
\[ \text{STEM(d)} \]
\[ \text{ROOT(e)} \]
\[ \text{root} \]
\[ \text{yok} \]
\[ \text{INFL(f)} \]
\[ \text{infl}_1 \]
\[ \text{la} \]
\[ \text{infl}_2 \]
\[ \text{pa} \]

(22a)

14.  
\[ \text{W(b)} \]
\[ \text{STEM(c)} \]
\[ \text{INFL(f)} \]
\[ \text{STEM(c)} \]
\[ \text{Suffix} \]
\[ \text{lak} \]
\[ \text{infl}_1 \]
\[ \text{i} \]
\[ \text{STEM(d)} \]
\[ \text{Suffix} \]
\[ \text{thok} \]
\[ \text{ROOT(e)} \]
\[ \text{root} \]
\[ \text{pu} \]

(23a)

15.  
\[ \text{W(b)} \]
\[ \text{STEM(c)} \]
\[ \text{INFL(f)} \]
\[ \text{STEM(c)} \]
\[ \text{Suffix} \]
\[ \text{lak} \]
\[ \text{infl}_1 \]
\[ \text{la} \]
\[ \text{infl}_2 \]
\[ \text{ka} \]
\[ \text{STEM(d)} \]
\[ \text{Suffix} \]
\[ \text{thok} \]
\[ \text{ROOT(e)} \]
\[ \text{root} \]
\[ \text{con} \]

(23b)
16. W(b) -> W(a)
   |     |
   |     | enc e
   |     |
   STEM(c) ->
   |         |
   |         | suffix
   |         | t\text{\textsuperscript{h}}\text{\textsuperscript{o}k}
   |         |
   STEM(d) ->
   |         |
   |         | root
   |         | k\text{\textsuperscript{h}o\text{\textsuperscript{k}}}
   |         |
   ROOT(e) ->
   root
   t\text{\textsuperscript{h}o\text{\textsuperscript{k}}}
   lak
   (25a)

17. W(b) -> W(a)
   |     |
   |     | enc e
   |     |
   STEM(d) ->
   |         |
   |         | INFL(f)
   |         |
   ROOT(e) ->
   root
   root
   t\text{\textsuperscript{h}o\text{\textsuperscript{k}}}
   lak
   (25b)

18. W(b) -> W(a)
   |     |
   |     | enc e
   |     |
   STEM(d) ->
   |         |
   |         | ROOT(e)
   |         |
   root
   root
   t\text{\textsuperscript{h}o\text{\textsuperscript{k}}}
   lak
   (28c)
19. W(a)
   /\  
  W(b)  e
     \ /     
    enc c

   STEM(d)  INFL(f)
  / \       / \ 
ROOT(e)  infl1  infl2
   \       / 
root la

(35e)

20. W(b)
   /\  
STEM(d) INFL(f)
   \ /   \ /
ROOT root
   /     /
infl1 infl2 infl3
   ta li
   \    / 
root la

(35a)

21. W(b)
  /\  
STEM(d) INFL(f)
 / \    / /
prefix ROOT(e) infl1 infl2
   \   / 
root pa ni
   \ / 
root eta

(37b)

22. W(a)
  /\  
W(b)  e
     \ /     
    enc c

   STEM(d)  INFL(f)
  / \       / \ 
ROOT(e)  infl1  infl2
   \       / 
root wa root kaf
REFERENCES


