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Level Ordered Morphology and Phonology in Manipuri

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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 Meithei or Meithlei, 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

	Labial	*Alveolar*	*Palatal*	*Velar*	*Laryngeal*
Stops	p	t	c	k	
	p^h	t^h	c^h	k^h	
Fricatives					h
Nasals	m	n		ŋ	
Lateral		l			
Semivowels	w		y		

Borrowed words exhibit the voiced unaspirated series /b, d, j, g/ and the voiced aspirated series /b^h, d^h, j^h, g^h/. The voiced aspirated stops occur in borrowed words only. The lateral /l/ varies freely with /n/ word finally; intervocalically, /l/ is realized as [r]. The aspirated palatal stop /c^h/ is phonetically realized as [s] or [s^h].[3] The phonemic status of the

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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:

i.	p/b	ipok	'my white hair'
		ibok	'my grandmother'
ii.	t/d	ləytənə	'not living there'
		ləydənə	'only the flowers'
iii.	k/g	ləykən	'hard surface'
		ləygənbə	'one who buys all the time'

As shown in (i) underived 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 Nameirakpam (1989).

iv.	a.	ipibok	'grandfather'	f. ibay	'elder brother'
	b.	ibok	'my grandmother'	g. dəda (təda)	'elder brother'
	c.	əbok iben	'grandmother'	h. pabuŋ	'father'
	d.	iben bok	'grandmother'	i. babə (or pabə)	'father'
	e.	ibuŋ	'elder brother'		

Example (ii) which purports to provide a contrast between /t/and /d/ is suspect since the marker *-də* which signifies 'only, exactly' has a variant *-tə* as in *mədutənə* '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 *-gən* 'to V habitually' has a variant *-kən* as in *cətkəlli* '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

	front	*central*	*back*
high	i		u
mid	e	ə	o
low		a	

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

	p	pʰ	t	tʰ	c	cʰ	k	kʰ	m	n	ŋ	l	w	y	h
syllabic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
sonorant	-	-	-	-	-	-	-	-	+	+	+	+	+	+	-
consonantal	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-
anterior	+	+	+	+	-	-	-	-	+	+	-	+	+	-	-
coronal	-	-	+	+	+	+	-	-	-	+	-	+	-	-	-
lateral	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
nasal	-	-	-	-	-	-	-	-	+	+	+	-	-	-	-
voice	-	-	-	-	-	-	-	-	+	+	+	+	+	+	-
strident	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-
spread glottis	-	+	-	+	-	+	-	+	-	-	-	-	-	-	+
continuant	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+

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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 /ʃ/ and /ʃh/ are allophones of /ch/. First, the absence of /ch/ would constitute a noticeable gap in the symmetry of the phonemic system. Second, /ʃ/ and /ʃh/ trigger rules such as DASP (see section 4.1.2), just like the other phonemes in the aspirated series, e.g. *ʃen* 'money'; *kʰaw* 'bag'; *ʃengaw* '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 /ʃ/ and /ʃh/ are underlyingly /ch/.

Figure 4. Feature specification of the vowel phonemes.

	i	e	ə	a	u	o
syllabic	+	+	+	+	+	+
sonorant	+	+	+	+	+	+
consonantal	-	-	-	-	-	-
high	+	-	-	-	+	-
low	-	-	-	+	-	-
back	-	-	-	-	+	+
round	-	-	-	-	+	+
tense	+	+	-	+	+	+

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 ——> W enc
   b. W ——> STEM (INFL)
   c. STEM ——> STEM (suffix)
   d. STEM ——> (prefix) ROOT
   e. ROOT ——> $\left\{ \begin{matrix} \text{ROOT} \\ \text{root} \end{matrix} \right\}$ (root)
   f. INFL ——> $\text{infl}_1, \text{infl}_2, \ldots \text{infl}_n$

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 irrealis 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] ——> N
   - ii. [V + N] ——> N
   - iii. [N + N] ——> N
   - iv. $[N + V]_N + V]$ ——> N
   - v. $[V + N]_N + V]$ ——> N
   - vi. [V + V] ——> V

B. Intracategory suffixation: for example, [V + suffix] ——> 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 + suffix] ——> V, which gives the meaning 'to be N'
   - ii. [V + suffix] ——> 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. [prefix + V] ——> N, which gives the meaning 'mode of Ving'
   - ii. [prefix + V] ——> ADJ, which gives the meaning 'being V-like'

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[4] The interrogative marker is coupled with the factive or irrealis 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*[5]

Syllable-initial[6] voiceless unaspirated stops are voiced between voiced segments, as formalized in R(ule)1.

$$\text{R1:}\quad \begin{bmatrix} -\text{ continuant} \\ -\text{ sonorant} \\ -\text{ spread glottis} \end{bmatrix} \longrightarrow [+\text{voiced}] \;/\; [+\text{ sonorant}]\ .\ \underline{\quad}\ [+\text{ sonorant}]$$

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.	ca	'eat'	cabə	'to eat'
b.	pʰə	'good'	pʰəbə	'to be good'

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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'	pikpə	'to be small'
d.	lak	'come'	lakpə	'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	t^ha	'moon'	t^hagi	'of the moon'
b.	mi	'man'	migə	'with the man'
c.	cin	'hill'	cində	'on the hill'
d.	p^hurit	'shirt'	$p^huritki$	'of the shirt'
e.	k^hut	'hand'	$k^hutkə$	'with the hand'
f.	lempak	'ground'	lempaktə	'on the ground'

The Voicing Assimilation rule also applies when the initial voiceless stop of a root occurs between two voiced segments in some compounds.[7] As illustrated in example 5(a-d), the Voicing Assimilation rule applies in N + V, N + N and [[N + N] +N] compounds.

5.

a.	b.	c.	d.
ləmboybə	unbantha	kumjin	nəmbo
ləm-poy-pə	un-pan-tha	kum-cin	nəm-po
noun-verb-vderv	*noun-noun-noun*	*noun-noun*	*noun-verb*
path-wander-agen	ice-rule-month	year-border	back-carry
'wanderer'	'winter'	'early part of the year'	'bundle'

Finally, the Voicing Assimilation rule applies when the derivational suffixes[8] *-t^hok* 'out' or *-$k^hət$* 'up' are suffixed to roots ending in a voiced 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 *-t^hok* and *-$k^hət$* are derived from the verb stems *-t^hok* 'occur' and *-$k^hət$* 'strike', respectively. Thus in 24a and 25b *-t^hok* 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 *-tʰok, -kʰət*	
a.	hi	'trim'	hidok	'trim outwards'
b.	tʰiŋ	'pierce'	tʰiŋgət	'pierce upwards'
c.	kʰik	'sprinkle'	kʰikkət	'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.[9] In example 7(a,b) for instance, the Voicing Assimilation rule does not apply with the affixation of the pronominal prefix *i-* 'first person possessive' or *mə-* 'third person possessive' where the root initial *p* in *pa* and *pu* does not voice even though it occurs between voiced segments.

7.	root		pronominal prefix *i-, mə-* + root	
a	pa	'father'	ipa	'my father'
b.	pu	'grandfather'	məpu	'his/her grandfather'

The Voicing Assimilation rule also does not apply with the affixation of the attributive prefix *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.		d.	
	ətənbə		əpakpə	
	ə-tən-pə		ə-pak-pə	
	vderv-verb-vinfl		*vderv-verb-vinfl*	
	att-short-inf		att-broad-inf	
	'that which is short'		'that which is broad'	

Similarly, the Voicing Assimilation rule does not apply with the prefixation of *mə-* 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.

7.	e.	məpa	f.	məkəŋ
		mə-pa		mə-kəŋ
		vderv-verb		*vderv-verb*
		mode-read		mode-dry
		'way of reading'		'way of being dry'

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

8.	a	ika	b.	həykon	c.	əcapot
		i-ka		həy-kon		ə-ca-pot
		noun-verb		*noun-noun*		*vderv-verb-noun*
		water-rise		fruit-place		att-eat-thing
		'flood water'		'orchard'		'food'

	d.	mitop	e.	lupəw	f.	paminnəbə
		mi-top		lu-pəw		pa-min-nə-pə
		noun-verb		*noun-verb*		*verb-verb-vinfl-vinfl*
		man-distinct		head-rough		read-company-recip-inf
		'stranger'		'dandruff'		'read together'

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. tika '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: [- sonorant] ——> [- spread glottis] / [+ 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 *-kʰət* '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, -kʰət*	
a.	tʰiŋ	'pierce'	tʰiŋgət	'pierce upwards'
b.	kʰik	'sprinkle'	kʰikkət	'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-pʰəw* but not with the formation of *pʰipəw-pəm*.[11]

11.	a	phibəwphəm	b.	phida	c.	phiga
		phi-phəw-phəm		phi-tha		phi-kha
		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	phikhən	b.	khonthaŋ	c.	thawthi
		phi-khən		khon-thaŋ		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] ⟶ [- lateral] / [+ syllabic] _____ [+ syllabic]

[11] Note that the [[N + V] + N] bracketing for *pʰipəwpʰəm* 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 *ə-* 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.	lembə	'remaining'	ərembə	'remainder'

The Trilling rule also applies when the perfect aspect marker *-lə* or the progressive marker *-li* 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-vinfl-enc		*verb-vinfl*
		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 *-lu* 'action takes place away from the speaker' (15b); the morpheme *-ləm* 'sequential' (15c); or the derivational suffix *-ləkˀ* 'come and do something' (15d) is suffixed to a root ending with a vocalic segment.

15.

a.	b.	c.	d.
pʰərəy	pʰəruy	carəmmi	ləyrəkpəni
pʰə-lə-i	pʰə-lu-i	ca-ləm-i	ləy-ləkˀ-pə-ni
verb-vderv-vinfl	*verb-vderv-vinfl*	*verb-vderv-enc*	*verb-vderv-vinfl-vinfl*
good-tdir-pres	good-adir-pre	seat-seq-exper	buy-dsource-inf-cop
'came here and is good'	'went there and is good'	'ate and went away'	'is bought'

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. wari libə
wa-li li-pə
noun-verb verb-vinfl
word-tell tell-inf
'narrate a story'

18. cəynə lakpə
cəy-nə lak-pə
noun-casem verb-vinfl
stick-agen come-inf
'stick by controlling'

4.1.4 *Total Assimilation of l*

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

R4: [+ lateral] ——> $\begin{bmatrix} + \text{ nasal} \\ \beta \text{ anterior} \\ \gamma \text{ coronal} \\ \beta \text{ Feature}_4 \\ \gamma \text{ Feature}_5 \\ \vdots \end{bmatrix} / \begin{bmatrix} + \text{ nasal} \\ \beta \text{ anterior} \\ \gamma \text{ coronal} \\ \beta \text{ Feature}_4 \\ \gamma \text{ Feature}_5 \\ \vdots \end{bmatrix} \_\_\_\_$

The rule of Total Assimilation of *l* applies when the derivational affixes *-lə* 'action takes place towards the speaker', *-lu* 'action takes place away from the speaker', *-ləkˀ* 'come and do something', and *-ləm* '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 *-ləm* 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 *-ləkˀ* is changed to a glottal stop under influence of the following present tense marker. Refer to the rule of *kˀ* 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 *-lə*. See R10 for further discussion of diphthongization.

19.

a.	b.	c.	d.
yeŋŋəmmi	lammɔy	pʰəmməʔi	iŋŋuy
yeŋ-ləm-i	lam-lə-i	pʰəm-lək-i	iŋ-lu-i
verb-vderv-vinfl	*verb-vderv-vinfl*	*verb-vderv-vinfl*	*verb-vderv-vinfl*
look-seq-pres	hungry-adir-press	it-dsource-pres	cold-tdir-pres
'comes and looks'	'came here and is hungry'	'came sitting (as on a bus)'	'went there and feels cold'

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

20. a.	b.	c.	d.
yeŋŋi	tɔmmoy	semmi	yeŋŋe
yeŋ-li	tɔm-loy	sem-li	yeŋ-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 *l* does not apply. For instance, in the compounds in example 21(a-b), the initial lateral *l* of the second stem of the compound, does not undergo the rule of Total Assimilation of *l* even though the phonological environment for the application of the rule is present.

21. a.	b.
kʰoŋləm	ləmloŋ
kʰoŋ-ləm	ləm-loŋ
noun-noun	*noun-verb*
leg-path	path-straight
'footpath'	'straight road'

4.1.5 *Lateral deletion*

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

R5: [+ lateral] ——> ø / [- anterior, - coronal, - spread glottis, - voice] _____

The Lateral Deletion rule applies with the affixation of the perfect aspect marker *-lə*, the progressive aspect marker *-li* or the derivational marker *-ləm* 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. yo?əbə
yok-lə-pə
verb-vinfl-vinfl
rear-perf-inf
'rear up'

b. purə?ibə
pu-lək-li-pə
verb-vderv-vinfl-vinfl
carry-dsource-prog-inf
'coming'

c. la?əmmi
lak-ləm-li
verb-vderv-vinfl
come-seq-prog
'carried here'

However, note that the Lateral Deletion rule does not apply when the derivational morpheme *-lək* '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 *l* of the derivational suffix *-lək* 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 *l* of *-lə* does delete under the influence of the preceding *k* of *-lək*. Note in 23(a,b), the additional application of the *k* to Glottal Stop rule (R8) which changes the intervocalic *k* of *-lək* to a glottal stop and the application of the Trilling rule (R3) which changes intervocalic *l* to *r*.

23. a. puthorə?i
pu-tʰo-lək-i
verb-vderv-vderv-vinfl
carry-out-dsource-pres
'carries out'

b. coŋthorə?əgə
coŋ-tʰok-lək-lə-kə
verb-vderv-vderv-vinfl-vinfl
jump-out-dsource-perf-ass
'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] ⟶ ø / _____ [+ 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.		b.	
	thorəkpə		puthorə?u	
	thok-lək-pə		pu-thok-lək-u	
	out-dsource-inf		carry-out-dsource-imp	
	'came out'		'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	b.	c.	d.
khokto?e	thoklakpə	caklem	khikloy
khok-thok-lə-e	thok-lak-pə	cak-lem	khik-loy
verb-vderv-vinfl-enc	verb-verb-vinfl	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 *coŋthorə?e* '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.	/coŋ-thok-lək-lə/	Lateral Deletion applies
	*[coŋ-thok-ək-ə]	environment for Velar Deletion no longer available
b.	/coŋ-thok-lək-lə/	Velar Deletion applies
	*[coŋ-tho-lə-lə]	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 *-lək* and the application of the Velar Deletion rule. The Lateral Deletion rule must be "turned on" only with the affixation of *-lək*. 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: ø ⟶ [+ consonantal; - spread glottis; β coronal; γ anterior; β Feature$_5$; γ Feature$_6$; . ; .] / [+ consonantal; - spread glottis; β coronal; γ anterior; β Feature$_5$; γ Feature$_6$; . ; .] . ____ V

The Gemination rule applies when the present tense marker *-i* (see example 27(a-d), the imperative marker *-u* (see example 27e-f), or the experiential evidential enclitic *-e* 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. nənnay	b. issəy	c. əŋŋəkpəni	d. ibbuŋŋo
nə-nay	i-səy	ə-ŋək-pə-ni	i-buŋ-o
2PP-servant	1PP-self	att-strange-inf-cop	1PP-master-voc
'your servant'	'ourselves'	'be strange'	'my master'

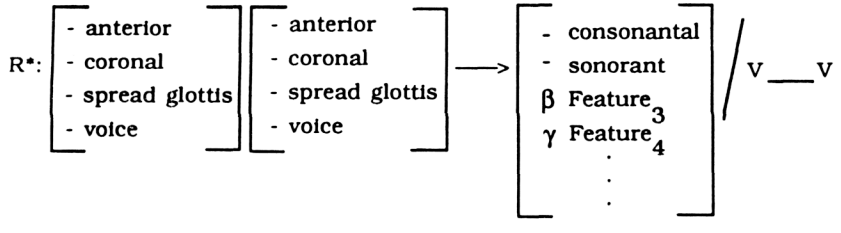
Note that the Gemination Rule applies in the same environment as the rule of Voicing Assimilation. Thus if the Gemination rule applies first, the Voicing Assimilation rule cannot apply, and if the Voicing Assimilation rule applies first, the Gemination rule cannot apply. In order to assure that these 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 intervocalically, 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 *-ləkk* 'come and do something', in example 28b when the imperative marker *-u* is suffixed to the stem *pithəkk*, and in example 28c when the experiential enclitic *-e* is suffixed to the verb *thəkk*, *k* appears as a glottal stop and not as a geminate.

28. a.	həllə?i	b. pithə?u	c. thə?e
	həl-ləkk-i	pi-thəkk-u	thəkk-e
	verb-vderv-vinfl	*verb-verb-vinfl*	*verb-enc*
	return-dsource-pres	give-drink-imp	drink-exper
	'returns'	'give to drink'	'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[13] as formalized in



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 *-ə*. 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* ——> *kk* by the Gemination Rule and then *kk* ——> *k* ——> ʔ by R*. Second, 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 *kʰikkət* (example 6c) where the *kk* sequence is not followed by the inflectional morphemes *-i*, *-u* or by the enclitic *-ə*. 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.

R8: $\begin{bmatrix} -\text{ anterior} \\ -\text{ coronal} \\ -\text{ spread glottis} \\ -\text{ voice} \end{bmatrix} \longrightarrow \begin{bmatrix} -\text{ consonantal} \\ -\text{ sonorant} \\ \beta\ \text{Feature}_3 \\ \gamma\ \text{Feature}_4 \\ \vdots \end{bmatrix} / \text{V} \_\_\_\_ \text{V}$

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 *kʰikkət*.

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.

R9: $\emptyset \longrightarrow \left[\begin{array}{l} -\text{ consonantal} \\ -\text{ sonorant} \\ \beta\ \text{Feature}_3 \\ \gamma\ \text{Feature}_4 \\ \vdots \end{array}\right] / \; V_i \_\_\_\_ V_j$

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.	məma əsinə	b. ŋa əsi
		mə-ma ə-si-nə	ŋa ə-si
		3PP-mother vderv-pdet-foc	*fish vderv-pdet*
		'his mother'	'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_iV_j where i=j. This process is formalized in R10.

R10: $V_j \longrightarrow$ [- syllabic] / V_i _____ 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.	tʰa	'plant'	tʰaw	'plants'
e.	ca	'eat'	caw	'eats'
f.	pa	'read'	paw	'reads'

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

32. a.	pʰərəy	b. pʰəruy
	pʰə-lə-i	pʰə-lu-i
	verb-vderv-vinfl	verb-vderv-vinfl
	good-adir-pres	*good-tdir-pres*
	'came here and is good'	'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 *-i* affixation, i. and ii. are incorrectly derived; in 33b, where the Diphthongization rule applies on *-mə* affixation, iii. is incorrectly derived.

33. a.

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

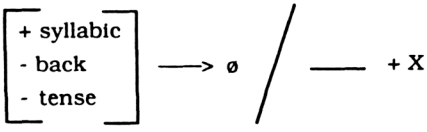
b.

i.	ii.	iii.	
V-*u*	V-*i*	*mə*-V	Diphthongization applies
V*w*	V*y*	**məy/məw*	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 *mə-* 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 *ə Deletion*

A rule exists deleting morpheme final ə as formalized in R11.



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.	ciŋsilli	b.	takʰərə
		ciŋ-sil-lə-i		ta-kʰə-lə-e
		verb-vderv-vinfl-enc		*verb-vinfl-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 ə Deletion is available. Also, ə Deletion must not be able to apply in the morphological environments where R9 and R10 apply.

The rule of ə Deletion applies when the negative morpheme *-tə* (35a,b), the factive marker *-pə* (35c), the irrealis marker *-tə* (35d), or the past perfect aspect marker *-kʰə* (35e) is followed by *l*. Note in each case the additional application, where possible, of the Voicing Assimilation rule and the Trilling rule.

35. a. phudriŋŋəy
phu-tə-li-ŋəy
verb-vinfl-vinfl-vderv
beat-neg-prog-during
'not during beating'

b. khəŋdrəbə
khəŋ-tə-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-tə-la
verb-vinfl-vinfl
beat-irr-pint
'did beat?'

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

The rule of ə Deletion does not apply in the majority of the available morphological environments. First, ə 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[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. hayrəgə
hay-lə-kə
say-perf-ass
'afterwards'

b. haybəsidə
hay-pəsi-tə
say-inf-pdet-dat
'therefore'

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

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

b. əŋəkpəni
ə-ŋək-pə-ni
att-strange-inf-cop
'be strange '

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

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[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.

38. əyuŋbə u
ə-yuŋ-bə u
vderv-verb-vinfl noun
att-erect-inf tree
'erected tree'

4.2 Phonological evidence for level-ordering

4.2.0 *Introduction*

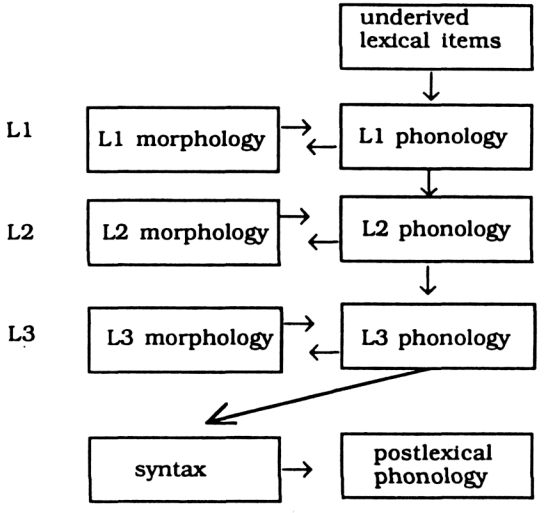
In section 4.1, I have attempted to illustrate that there are phonological rules in Manipuri which apply in certain morphological environments but fail to apply in others. Additionally, it has been seen that certain rules need to be ordered with respect to each other: the Deaspiration rule must apply 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, underived 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.

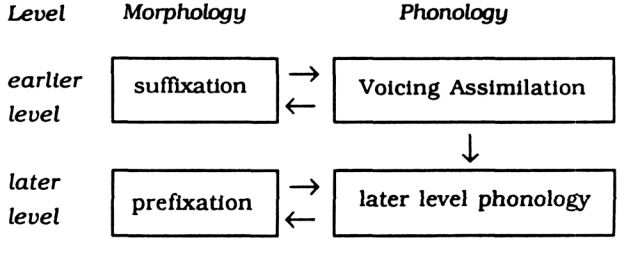
Figure 6: A summary of the interaction between the morphology and phonology

Phonological Rule	*Applies with the affixation of these morphemes*	*Does not apply with the affixation of these morphemes*
R1 Voicing Assimilation	infinitive *-pə*; case markers; some compounds; *-tʰok*, *-kʰət*	pprefix *-i*, *mə*; attributive prefix *ə-*; derivation V—>N, *mə-*; some compounds; borrowed words
R2 Deaspiration	*-tʰok*, *-kʰət*; some compounds	some compounds
R3 Trilling	pronominal prefix *i-*, *mə-*; attributive prefix *ə-*; aspect markers *-lə*, *-li*; directional markers *-lə*, *-lu*, *-lək*, *-ləm*; some compounds	between words; some compounds
R4 Total Assimilation of *l*	directional markers *-lə*, *-lu*, *-lək*, *-ləm*; aspect markers *-lə*, *-li*; negative future *-loy*	some compounds
R5 Lateral Deletion	aspect markers *-lə*, *-li*	directional *-lək*
R6 Velar Stop Deletion	directional *-lək*	aspect *-lə*; some compounds
R7 Gemination	verb inflection *-i*, *-u*; vocative *-o*; enclitic *-i*, *-e*	

R8 *k* to Glottal Stop	verb inflection *-i, -u*; vocative *-o*; enclitic *-i, -e*	
R9 Glottal Stop Insertion	derivational V —> N, *mə-*	between words; imperative *-u*; tense *-i*
R10 Diphthongization	imperative *-u*; tense *-i*	derivation V —> N, *-mə*; imperative *-u*; tense *-i*; clausal subordinators *-rəgə, -bəsidə*; attributive *-ə*; pprefix *mə-*; between words
R11 *ə* Deletion	enclitic *-i, -e*; negative *-tə* followed by *-rə*; polarity interrogative *-ra*; past perfect *-k^{h}ə*	derivation V —> N, *mə-*

Consider first the case of Voicing Assimilation (R1). It was noted that R1 does apply with cases of suffixation 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.



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.[16] 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 *-l i* and *-l ə* and the directionals *-l ə*, *-l u* and *-l əm* while the Velar Deletion rule applies with the suffixation of *-l ək*. In order to make certain that Lateral Deletion does not apply with the suffixation of *-l ək*, the rule can be paired with the affixation of the specified aspectual and directional markers at a level different from that of *-l ə* 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 *-l ək* 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 *-lək* and *-lə* affixation, is to consider the linear order of these morphemes. In a form like *coŋthorə?əgə* (see example 23b for gloss of morphemes) it is clear that *-lək* affixation occurs before the affixation of *-lə*. Thus, *-lək* affixation is assumed to occur, along with the application of the Velar Deletion rule, at a level before the affixation of *-lə*.

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

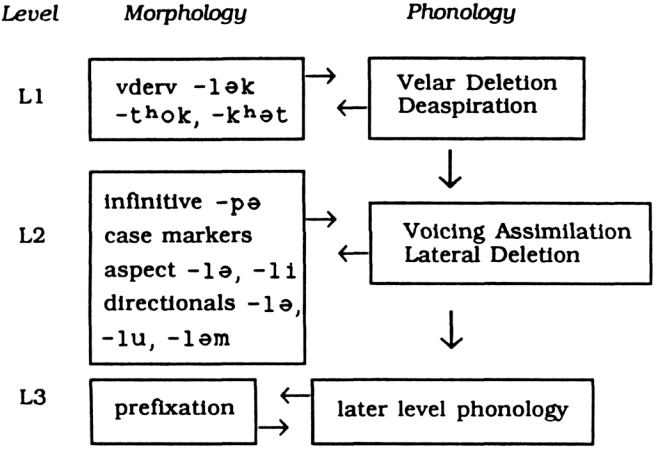
40.	*earlier level*	coŋ-thok-lək coŋtholək	Velar Deletion applies
	later level	coŋtholək-lə coŋtholəkə	Lateral Deletion applies
		further morphology and phonology [coŋthorə?əgə]	

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, *-lə* is affixed before the L2 infinitive marker (41a) and before the L2 associative marker (41b).

41.	a. carəbədi	b. carəgə
	ca-lə-pə-ti	ca-lə-kə
	eat-perf-inf-ex	eat-perf-ass
	'if (I) eat'	'after eating'

Thus *-lə* 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 *coŋthorə?əgə*, *-lək* is affixed after the derivational marker *-thok* in the linear order. Since *-lək* must be affixed before the affixation of *-ə*, I will assume that *-thok* (also *-khət*) as well as *-lək* are affixed at a level before the affixation of *-lə*. 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.

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 *carəy* 'has eaten' from *ca* '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.

43.

L2	*-u* imp *-i* present tense	Diphthongization
L3	*mə-* prefixation	Glottal Stop Insertion

4.2.4 *Trilling and Total Assimilation of l*

Recall that the Trilling rule and the Total Assimilation of *l* rule, apply with both the L1 affixation of *-lək* and the L2 affixation of the directional suffixes *-lə*, *-lu* and *-ləm*, the aspect markers *-li*, *-lə*, and the negative future marker *-loy*. 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-*, *mə-*, the derivational prefix *mə-*, and the attributive prefix *ə-*. For these reasons, I will assume that the Trilling rule applies at L3. However, I will assume that the rule of Total Assimilation of *l* 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 *ə Deletion*

Consider now the ordering of the ə 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 *-ə* 'dragged in' (see 34a for a gloss of morphemes) is given showing the application of the rule of ə Deletion after the affixation of the enclitic *-i*.

44.	L2	ciŋ-sil-lə	
	enclitic phonology	ciŋsillə-i [ciŋsilli]	-ə Deletion applies

Recall that *-ə* also deletes in the sequences *tə-li* 'negative + progressive', *tə-lə* 'negative + perfect', *pə-lə* 'factive + yes-no interrogative', *tə-lə* 'irrealis + polarity interrogative' and *kʰə-lə* 'past perfect + perfect'. In each of these cases, *-ə* deletion cannot apply until after the trilling of *l* in intervocalic position and the voicing of *t* and *p* in the case of the negative, factive and irrealis markers. Thus *-ə* 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 *hayrəgə* (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 *hayrəgə* 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. $\left\{\begin{matrix} p, p^h, b, \\ t, t^h, d, \\ k, k^h, g \end{matrix}\right\}$ ərə

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

46.

$$\text{R11a:} \quad \begin{bmatrix} +\text{ syllabic} \\ -\text{ back} \\ -\text{ tense} \end{bmatrix} \longrightarrow \emptyset \; / \; \begin{bmatrix} -\text{ sonorant} \\ \beta\text{ coronal} \\ \gamma\text{ anterior} \end{bmatrix} \_\_ \begin{bmatrix} +\text{ sonorant} \\ +\text{ coronal} \\ -\text{ anterior} \end{bmatrix}$$

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 *kʰoŋləm* and *ləmloŋ* (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 *tʰoklakpə*, *caklem* and *kʰikloy* (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 *warilibə* does not undergo the L3 rule of Trilling, it is assumed to be formed post-lexically from the lexically formed noun *wari* 'story' and verb infinitive verb *libə* '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 *unbantʰa* 'winter' is derived from the stems for *ice*, *rule* and *month*; and the L3 compound *kʰikloy* '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.[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

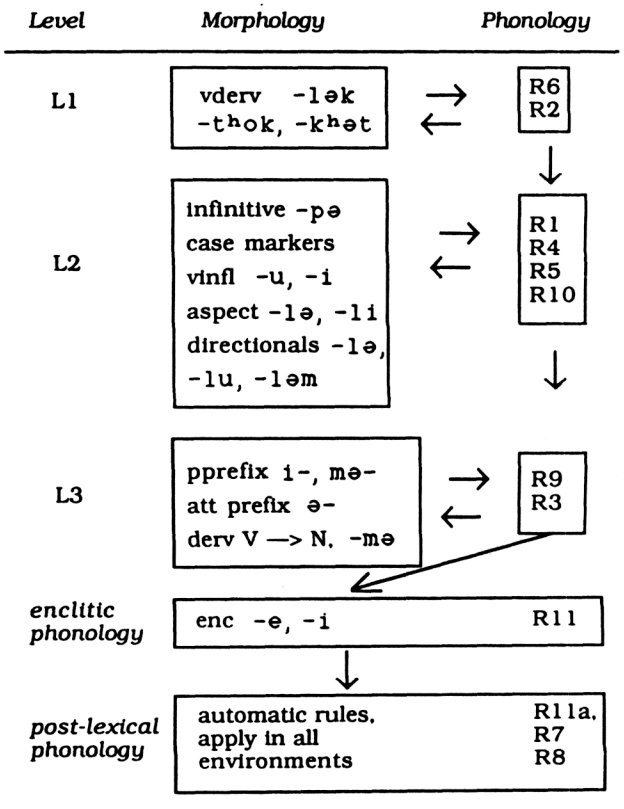
L2 regular derivation and inflection
compounding

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.

[17] See Chelliah (in press) for more on the level-ordering of compounds.

Figure 7: Level ordering of morphological and phonological rules



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

Row 1: gives abbreviation
Row 2: identifies function of the morpheme
Row 3: gives morpheme

adir	action takes place away from the speaker	-lu
acc	accusative	-pu
agen	agentive	-pə
ass	associative	-kə
att	attributive	ə-
cop	copula	-ni
dat	dative	-tə
dsource	come and do something	-lək
exper	experiental evidential	-e
fac	factive	-pə
gen	genitive	-ki
intj	interjection	
imp	imperative	-u
inf	infinitive	-pə
irr	irrealis	-tə
loc	locative	-tə
neg	negative	-tə
negfut	negative future	-loy
pdet	determiner signifying proximity	-si
pint	polarity interrogative	-la
perf	perfect aspect	-lə
pperf	past perfect marker	-kʰə
prog	progressive aspect	-li
recip	reciprocal	-nə
seq	sequential	-ləm
tdir	action takes place towards speaker	-lə
voc	vocative	-o
1PP	first person possessive	i-
2PP	second person possessive	nə-
3PP	third person possessive	mə-

2. Abbreviations used for glossing categories

casem	case marker
enc	enclitic
nderv	noun derivation
ninfl	noun inflection
vderv	verb derivation
vinfl	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

pabə 'to read'
pʰabə 'to catch'

2. Alveolar stops: t/tʰ

tabə 'to hear'
tʰabə 'to plant'

3. Velar stops: k/kʰ

kabə 'to climb' (PCT)
kʰabə 'to be bitter' (PCT)

4. Affricates: c/cʰ

cabə	'to eat'	ciŋ	'hill'
cʰabə [sabə]	'to impress'	cʰiŋ [shiŋ]	'ginger'

5. Nasals: m/n/ŋ

ma	'bed bug'
na	'ear'
ŋa	'fish'

6. Semivowels: w/y

waŋbə	'to be tall'
yaŋbə	'to be swift'

7. Laryngeal and lateral: h/l

hanbə	'to place, put'
lanbə	'to cross'

8. Vowels
(a) Initial position

ibə	'to write'
ubə	'to see'
oibə	'to be'
ərembə	'residue'
arambay	'plane'

(b) Medial Position

kəŋ	'aquatic plant'
kaŋ	'chariot'
kuŋ	'dense'
koŋbə	'fine' (verb)
keŋ	'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?'
care	'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 ——> W enc

b. W ——> STEM (INFL)

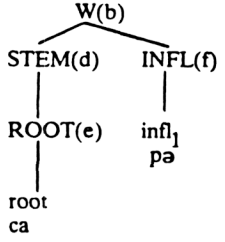
c. STEM ——> STEM (suffix)

d. STEM ——> (prefix) ROOT

e. ROOT ——> $\left\{ \begin{matrix} \text{ROOT} \\ \text{root} \end{matrix} \right\}$ (root)

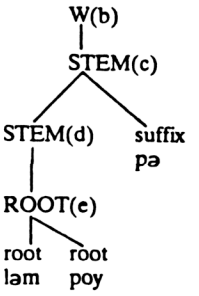
f. INFL ——> $\text{infl}_1, \text{infl}_2, \ldots \text{infl}_n$

1.



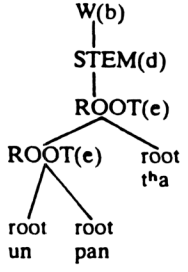
(3a)

2.



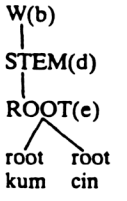
(5a)

3.



(5b)

4.



(5c)

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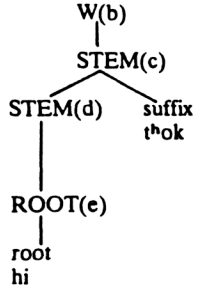
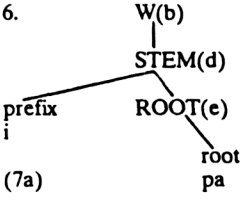


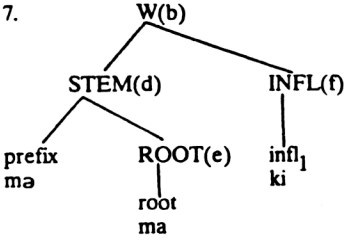
(6a)

6.



(7a)

7.



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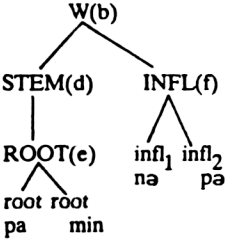
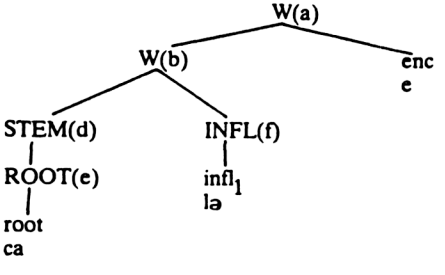


(8f)

məmagi
mə-ma-ki
3PP-mother-of
of his mother

9.



(14a)

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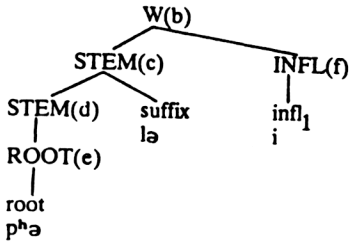
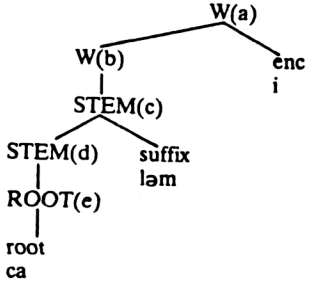


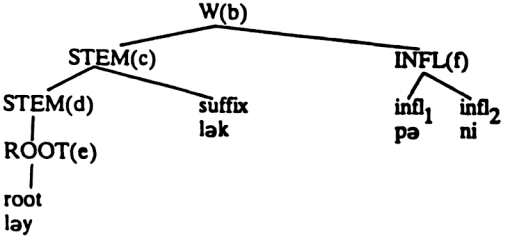
(15a)

11.



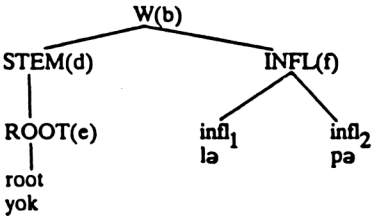
(15c)

12.



(15d)

13.



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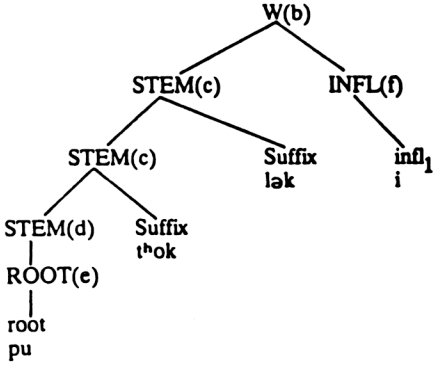

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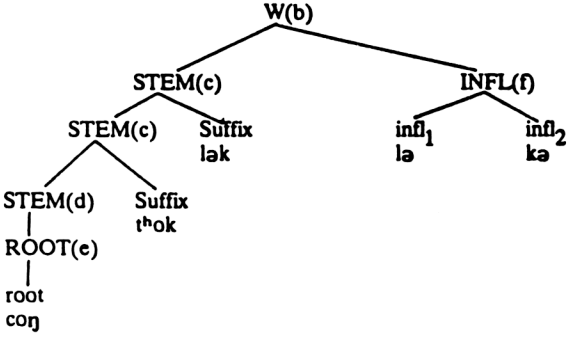
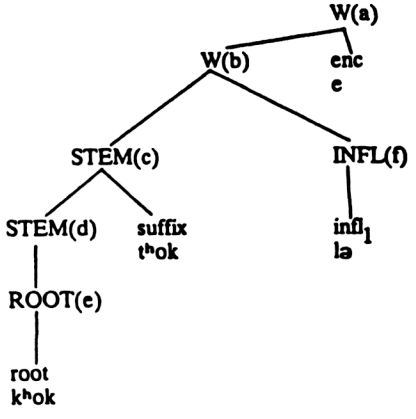


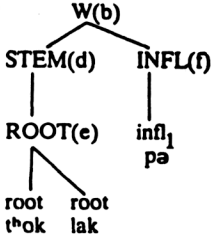
(23b)

16.



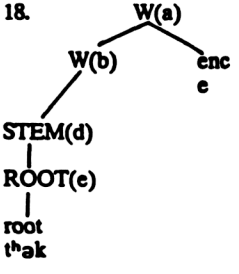
(25a)

17.



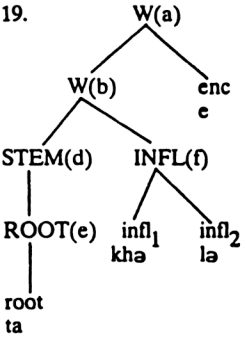
(25b)

18.



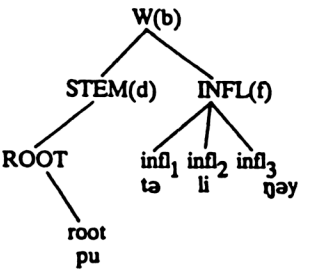
(28c)

19.



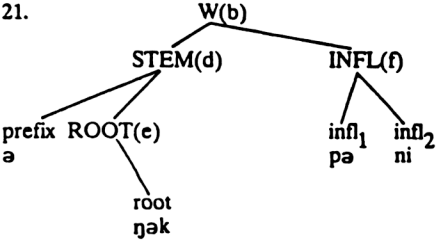
(35e)

20.



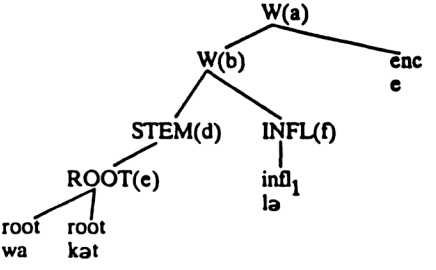
(35a)

21.



(37b)

22.



(49a)

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