TOWARDS A PHONOLOGY OF HRUSSO

AKA

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Abbreviations

ADJ.PART	adjectival participle
AT	Articulator Theories
COND	conditional
CONSEQ	consequential
CS	a Consonant-Sibilant sequence forming an onset cluster
FUL	featurally Underspecified Lexicon
FUT	future
HVDel	High Vowel Deleting
HVDv	High Vowel Devoicing
IMPER	imperative maker
INCL	inclusive marker morpheme
IND	indicative mood particle
ITER	iterative
LC	language Consultant
LOC	locative
NEG	negative marker
NOM	nominalizer
PERF	perfect
PL	plural
PS	palatalization series
PST	past
PURP	purposive
Q	question marker
SG	spread glottis
UFT	Unified Feature Theory

Introduction

This thesis is a preliminary study of the phonology of Hrusso Aka, a minority language of Northeast India. Its goals are twofold. The first is that this study should benefit the native speaker community of Hrusso Aka speakers. As the younger generation is abandoning this small language, and in the face of language loss that is staring at the Hrusso Aka community, there is an urgent need to create written material, and to create written material a sound orthography is needed. The present orthography, in the creation of which I was privileged to play a part, has some unsolved issues, and I hope to clarify them through this study.

The second goal is to explore what contribution Hrusso Aka might make to the current phonological theory. Being an unstudied language that is dissimilar to any neighbouring languages, does it have any interesting aspects worth exploring? To answer this question I aim to get an overall picture of the Hrusso Aka phonology through this preliminary study, so that aspects that are worth exploring can be identified for further research.

These two goals have guided the topics discussed here. In keeping with the first goal, consonant clusters, high vowel devoicing and syllable structure are discussed at some length. The rest of the thesis is a general and broad study of Hrusso Aka phonology, aimed more at raising questions than providing answers, because it is not yet known what the questions are.

This thesis has six chapters. In the first chapter I give general information on the Hrusso Aka language and discuss the data and the methodology. The second chapter will introduce the sound system of Hrusso Aka to the reader. I will be using the Featurally Underspecified Lexicon (FUL) model for the feature analysis of Hrusso Aka. In the third

chapter I introduce this model and apply it to Hrusso Aka. The fourth chapter is dedicated to introducing some salient morpho-phonological processes. High vowel devoicing, vowel harmony and vowel sequence constraints are some of the topics discussed therein. The fifth chapter is on the Hrusso Aka syllable. There is also a brief excursus on stress, paving the way for further research on the Hrusso Aka prosody. The sixth chapter is on the Hrusso Aka consonant sequences. In this chapter I distinguish between various types of consonant sequences, discuss their phonological behaviour and raise pertinent issues for further research.

Chapter 1. Preliminaries

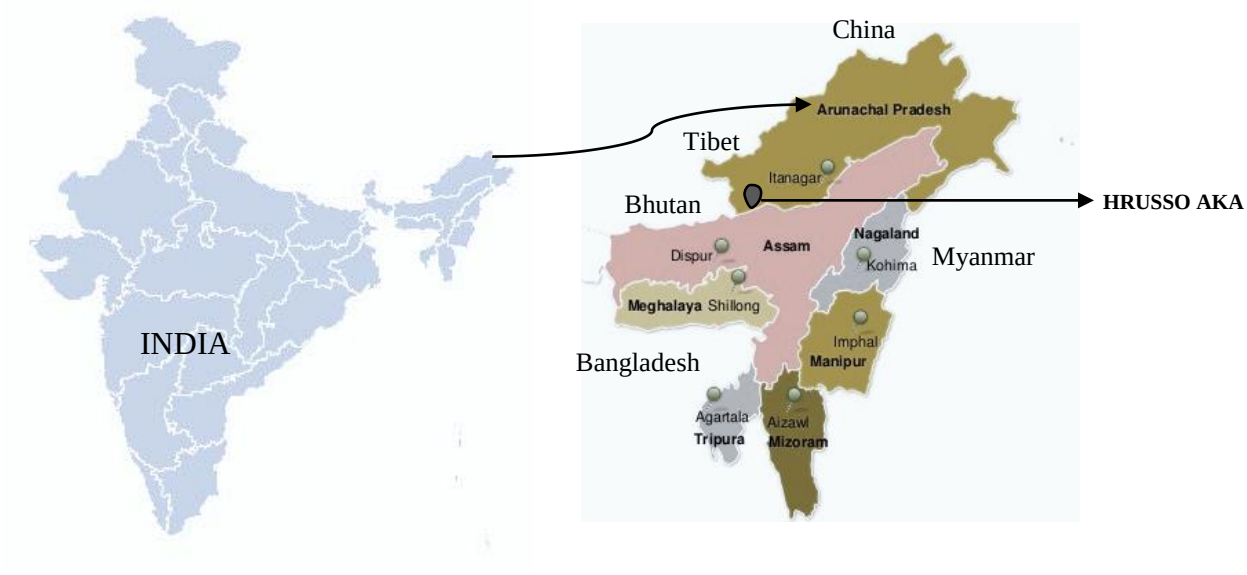
1.1 General Context

The Hrusso Aka tribe is located in the West Kameng district of the mountainous state of Arunachal Pradesh, Northeast India. Arunachal Pradesh, geographically the largest state in in Northeast India, and surrounded by Assam, China, Tibet, Myanmar and Bhutan is known to be sparsely populated and remote. The Himalayan state is inhabited by 26 major tribes and has a population of 1.4 million. Census of India 2011 shows that its population density of 17 per km^2 is the lowest in the country, as against the national average of 384 per km^2. Arunachal Pradesh had remained closed to outside influences till recently due the conscious policy of the Indian government of 'protecting' the tribes. Although there are still restrictions at present regarding entry and residence of outsiders, since the 1990's the state has been steadily opening up to the outside world, mainly due to the efforts of the educated Arunachalis.[1]

Arunachal Pradesh has the distinction of being the most linguistically diverse state in the country. According to Linguistic Survey of India–2013, of the 780 Indian languages, Arunachal Pradesh is home to 90 (Singh 2013). Most of these languages, including Hrusso Aka, are small, undocumented and quickly disappearing. While the recently increased contact with the outside world and access to television have brought in Hindi as the lingua franca, the Government policy of English medium education has made it the prestigious language of the educated elite. As a consequence, indigenous languages of the state are being pushed to the edge of extinction.

[1] 'Arunachali' - of Arunachal, used both as a noun (he is an Arunachali) and an adjective (An Arunachali girl). This is a construction borrowed from Hindi, and is used commonly in Indian English. (Bengali – of Bengal, Punjabi – of Punjab etc.)

Figure 1: Geographical Location of Hrusso Aka tribe[2]



1.2 The Hrusso Aka Language

Arunachal Pradesh is dominated by the Tani subgroup of the Tibeto-Burman family, to which the larger languages like Nyishi, Apa Tani and Galo belong. Non-Tani languages are small, and have a few hundred to a few thousand speakers. Hrusso Aka is a non-Tani language spoken by the members of the tribe that call themselves [ʁusso]. *Aka* is the exonym recorded since the British rule in India, but perhaps dates earlier than that. The term Hrusso Aka, obviously a concatenation of the autonym and the exonym, is used to distinguish them from the (sub) tribe Koro Aka that is culturally the same as the Hrusso Akas but has a different language.

The Hrusso Aka people number about 4,000 (Nimachow 2011) out of which actual speakers of Hrusso Aka are estimated to be around 3,000 (Lewis et al. 2015). The language is getting increasingly endangered due to an unprecedented shift towards Hindi.

[2] Maps based on Survey of India, Government of India. (Cf. Survey of India 2002a, 2013b).

1.2.1 Language Affiliation

Though its dissimilarity with the neighbouring languages has been noted since British times especially due to its fricative phonology (Grierson 1909), the exact language affiliation of Hrusso Aka is not known. Blench & Post (2011, 2014) suggest that it might be a language isolate, or a direct descendent of the proto Sino-Tibetan with no relatives in the Tibeto-Burman family. Lack of any reliable linguistic data on the language has been a hurdle in classifying Hrusso Aka. Going through the existing word lists and glossaries one notes that they are inconsistent and confusing mainly due to failure to understand the phonological system of the language, without which its sounds are very difficult to perceive and record. I hope the present study will be able to shed some light on this interesting question.

1.2.2 Dialects of Hrusso Aka

There are two major dialects of Hrusso Aka - /ʁuso/ (henceforth *Ĝuso*) and χuʂɯɲ/ (henceforth *hushin).* There are only minor differences between the two in terms of lexicon and grammar. One important phonological difference is that the *Hushin* uses /s/ and /z/ wherever the *Ĝuso* has /ʃ/ and /ʒ/. There are also prosodic differences between the two dialects, which the native speakers easily recognize.

There is much confusion about the Hrusso Aka dialects in the sparse literature available on the language. The neighbouring Koro Aka, which is a distinct language (Anderson & Murmu 2010), is sometimes considered a dialect of Hrusso Aka (Nimachow 2011; Sinha 1962). Shafer (1947), in his word list of the so-called Hrusso Aka dialects A and B confuses Miji (‘dialect’ A) and Hrusso (‘dialect’ B) languages. *Ĝuso* and *Hushin* are the only dialects recognized by most native speakers.

The *Ĝuso* dialect is spoken in Buragaon, Jamiri and the surrounding villages and *Hushin* is spoken in the villages carved out of the old Dijangania village. This study is confined to the phonology of the *Ĝuso* dialect.

1.3 Previous Literature on Hrusso Aka

The only book available on Hrusso Aka language *per se* is Simon's *Aka Language Guide* (Simon 1970), a part of the series of publications on Arunachali languages written by various government officers and published by the government research directorate. *Aka Language Guide* consists of some elementary grammar, 127 basic sentences and phrases, a 700-word Aka-English and English-Aka glossary. In the 3-page long first chapter titled 'phonology' it lists the following consonants and vowels. The symbols and brackets are reproduced here as in Simon (1970 pp. 1–2), and do not represent the present conventions.

Table 1.1: Simon's Hrusso Aka consonant inventory

p	ph	b	…	m
…	f	…	v	…
t	th	d	…	n
c	ch	j	…	ñ [ny]
k	kh	g	…	ŋ [ng]
…	χ [hh]	…	Y [gh]	…

y, r, l, w, s, ʃ [sh], z, n, h

Affricates: ts, dz, ks, gz.

Vowels: a, ɛ/e, i, ə[í], ɔ/o, u, ú[ü]

Simon somewhat followed the Devnagari alphabetical arrangement used for Sanskrit and most of the Indian languages. This explains the grouping of the stops, the non-sibilant fricatives and the nasals by places of articulation; distinction between the aspirated and non-aspirated stops (because of which there are blanks in the voiced aspirated plosives slot in Table 1.1); and the grouping of liquids, sibilants and glides separately. Unfortunately this alphabetical arrangement does not suit the languages of Northeast India since it does not reflect their phonological structure. Therefore, in effect Simon's alphabet was an attempt to fit the Hrusso Aka sound system into the Sanskrit template.

To Simon's credit, he recognizes the presence of the velar/uvular fricatives is and assigns the symbols χ [hh] and Y [gh][3] to them, but he calls them laryngeal fricatives. Some of the vowels and consonants are over-differentiated (eg. p-ph, t-th, kh-k which are allophones) and others are left out (eg. the retroflex sibilants).

Simon's book has not contributed much to the Hrusso Aka writing system in a major way, but it might have started a couple of trends like writing /ɯ/, the high back unrounded vowel, with 'i' thus leading to a confusion between /i/ and /ɯ/ which is a problem even today. Another trend is representation of /ʁ/ the velar fricative with /r/. Surprisingly, Simon himself started these trends in his sentence list and glossaries. While he designated 'ü' and 'gh' for /ɯ/ and /ʁ/ in the alphabet chart, he constantly uses the letters 'i' and 'r' for these same sounds throughout the book. *Aka Language Guide* contributed the symbols ü and ñ for /ɯ/ and /ɲ/, to the Hrusso Aka orthography. These symbols were incorporated in the new orthography I designed in 1999 for the publication of Rumo et. al. (1999).

[3] Bracketing as in Simon – he uses the square brackets to indicate orthographic representation.

Other sources on Hrusso Aka are obscure and limited, often short vocabulary lists or a few paragraphs in larger ethnographical works and none of them deal directly with phonology (cf. Hesselmeyer 1868; J. D. Anderson 1896; Konow 1902; Shafer 1947, 1955; Grierson 1909; Schubert 1964; Blench & Post 2014). The alphabet primer 'Ako na Kako' (D'Souza et al. 2005) contains a very brief introduction to the logic of the Hrusso Aka alphabet, explaining its phonemic basis albeit in an amateur linguist's language.

In the absence of any significant previous study and literature on Hrusso Aka, I have relied exclusively on the field data that I collected with the help of the native-speaker language consultants. I describe the types of data and the collection methodology below.

1.4 Data

The data for this study was collected at two different time periods. The specific data for phonological study was collected during my 2014 summer fieldwork. I have also extensively used the data that I had collected from 1999-2012 during my association with the Hrusso Aka tribe. I shall describe each of these data sets below.

1.4.1 Fieldwork Data

During the fieldwork, I elicited the data from the native speakers of Buragaon, Palizi, and Jamiri villages where *Ĝuso* dialect is spoken.[4] All the fieldwork data was both audio and video recorded for subsequent analysis. The data included the following types:

1.4.1.1 Natural language:

This amounted to 6 hours of recorded data under the following categories:

[4] See the Acknowledgments page for details of the native speaker consultants.

a. Natural conversation.

b. Language of narration especially myths and stories.

c. Language of description (events, natural phenomena etc.).

d. Traditional songs.

The following protocol was followed for each recording of natural language data:

(1) Recording protocol for natural language data

a. Begin recording (both audio and video recording).

b. Explanation and obtaining informed consent on record.[5]

c. Recording as long as the speaker/s felt comfortable on the given topic (usually 10-20 minutes)

d. End recording.

1.4.1.2 Controlled data

Controlled data consisted of approximately 1200 tokens that were captured in around 5 hours of recording. The tokens were of the following categories:

i. Word lists

A word list was carefully prepared in consultation with the research consultant DK, which included about 600 words that would represent all possible combinations of the Hrusso Aka sounds[6]. All these words were recorded from the main language consultant DS, after obtaining informed consent, using the following data recording protocol:

[5] See appendix 2 for the Informed Consent form.

[6] This list was drawn up on the basis of (a) My previous knowledge of Hrusso Aka. (b) DK's judgments on what might be important, (c) A checklist of all possible combinations of vowels and consonants.

(2) Data recording protocol for word lists

a. The researcher reads out the required word.

b. Begin recording (both audio and video simultaneously),

c. The language consultant utters the word once and translates it into Hindi.

d. The language consultant utters the word thrice in Hrusso Aka at a normal speed.

e. The language consultant makes a sentence using the word.

f. End recording.

Typically, a sound and video file of 15-30 seconds was obtained for each test sound. The protocol enabled the recording of words in isolation (three repetitions in isolation) as well as in sentences with a natural flow.

After eliciting the 600 words from the main language consultant, the list was reduced to 200 words, again reflecting all the important components of the Hrusso Aka phonology, and recordings were obtained from three more speakers – one male and two female. During analysis, these recordings were compared with the main language consultant's recordings for consistency and cross-speaker variation.

The video recording was done according the method suggested by Ladefoged (2003 p. 33); with the language consultants facing the camera, and a mirror on his/her side to capture the side view. This was useful for the observation of lip gestures and other facial expressions.[7]

[7] The side view proved to be quite useful to identify devoiced vowels. See Figure 11.

ii. Sentences in Slow Speech

These sentences were elicited as part of the Vowel Insertion Experiment explained in Chapter 6. The methodology of elicitation is explained in the same section. Recordings were obtained from the same 4 speakers from whom the word lists were elicited.[8]

iii. Sentences with Pikean Residues[9]

These were about 50 sentences elicited from the same language consultants. The sentences were formulated in such a way that each of them contained a pair of ambiguous phonemes or 'Pikean residues.' The following example illustrates one such sentence, which had the pair /s/ and /ʃ/.

(3)

I	**s**ɯyo	kʂɯde	**ʃ**ɯ	kada.	
He	bamboo.from	pierce.due.to	blood	came.	□

He was pierced with bamboo and (therefore) bled.

Such recordings placed similar sounding segments whose status was not clear within a single sentence so that they could be compared easily.

iv. Controlled data after the fieldwork

After the fieldwork, whenever specific questions arose during the course of this study, further data was collected through telephone or written correspondence with native speakers

[8] This was augmented by telephonic elicitation of slow speech from DK during the course of analysis.

[9] i.e., phonemes whose contrastive status is not clear. (Pike 1947)

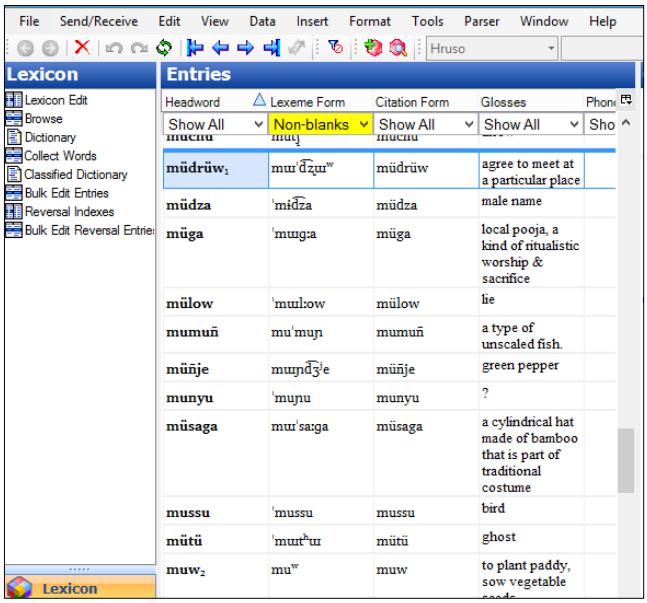
1.4.2 The text corpus and older recordings

This was mainly a 33,000 word written text corpus built over the last 15 years, and audio recordings of various types. The text corpus was composed of conversations, word lists, elicited sentences, poetry, hymns and stories. This data is orthographic and contains some inconsistencies. However, it was a valuable tool for cross-checking and verifying findings based on the fieldwork data. The method used for this was corpus linguistic search and analysis using Antconc software.

1.4.3 Transcription and Analysis

Once the data was collected and organized with the relevant metadata,[10] DK and I undertook the work of transcription, which is still ongoing. For the purpose of this paper two types of transcription were made: first, transcription of the word list and second, transcription of a part of natural language data.

Figure 2: a sample of transcription in FLEx



[10] Metadata was recorded as per standard practices suggested by Austin (2012)

The word list transcript was directly done on FLEX software by SIL to create a lexicon. This transcription was the starting point for the data analysis. Natural language data, mainly stories and narrations by various speakers, was transcribed phonemically to obtain a 10,000 word phonemic corpus. Each word from this corpus was fed into the software Phonology Assistant by Summer Institute of Linguistics. This was the main source for the analysis of connected speech and resyllabification.

I started the analysis of the sound structure of Hrusso Aka was started with a relook at the phonemic units of Hrusso Aka. I shall describe this in the next Chapter.[11]

[11] This was based on the tentative list of phonemes I had worked out earlier for developing the orthography.

Chapter 2. Vowels and Consonants

2.0 Introduction

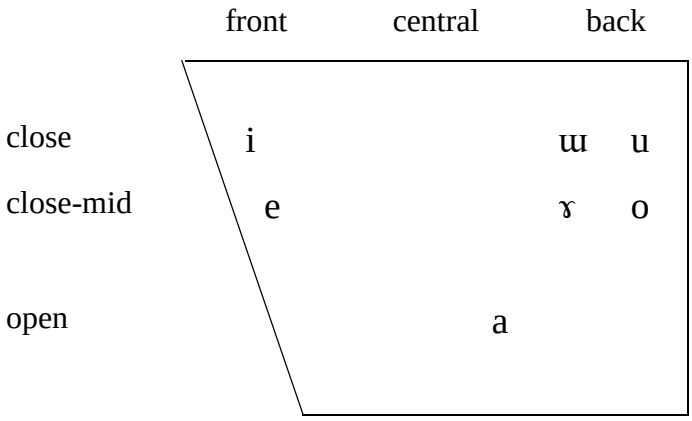
In this chapter I describe the phonemic units of Hrusso Aka. Though the contemporary phonological theory has moved beyond phonemes, it is nevertheless a useful concept as a starting point for categorization of the sound units in a language (Wiese 1996 p. 9). The phonemes of Hrusso Aka are listed as separate groups of vowels and consonants below. The methodology followed for the identification and description of phonemes was based on Pike's (1947) classic work *Phonemics* and Burquest (2006). Following the standard practice for the identification of phonemes, after a brief description of each phoneme I shall also list minimal pairs showing contrasts between them. Under each phoneme I shall also list its allophones and their contexts. I shall conclude the chapter with a discussion on some of the problems I faced in characterization of phonemes, and some outstanding issues.

Hrusso Aka is an agglutinating language. Words are made up of either free or concatenated lexical roots. Monosyllabic roots are the most frequent, and the maximal root length is two syllables. Lexical root level is where one should observe the segment behaviour in the language, since this is where segmental constraints and core syllabification operate.

2.1 Vowels

Hrusso Aka has seven vowels distinguishable on the basis of place of articulation, tongue height and roundedness. There is no vowel length contrast in the language.

Figure 3. Hrusso Aka vowels



2.1.1 High Vowels

The high vowels, or the close vowels, are the high front unrounded vowel /i/, the high back rounded /u/ and high back unrounded /ɯ/.

The vowel /ɯ/ is like the English schwa in many respects. It undergoes reduction and deletion in unstressed syllables, and is also the default epenthetic vowel. Its surface expressions are [ɯ] and its fronted variety, the high central unrounded vowel [ɨ]. The alternations are phonetically controlled. [ɨ] occurs only following dentals, and [ɯ] elsewhere.

(4) Alternants of /ɯ/

a. /dɯ-/ ‘push’ [dɨ] *[dɯ]

b. /gɯ/ ‘beat’ [gɯ] *[gɨ]

The high vowels are involved in many important phonological processes. Some of them will be discussed in Chapter 4.

2.1.2 Mid Vowels

The mid vowels are the close-mid front unrounded /e/, the close-mid back rounded /o/ and the close-mid /ɤ/. The first two have a tense-lax variation [e]~ [ɛ] and [o]~ [ɔ] respectively. The variants seem to be in a free variation as there is no regular pattern of variation. However, younger speakers generally prefer the tense variety but older one the lax.

The close-mid back unrounded vowel /ɤ/ is somewhat problematic. It is discussed separately in the section 2.1.6 below.

2.1.3 The low vowel

The vowel /a/ is the open (low) central unrounded vowel. It is the most frequently occurring vowel in the language. It is pharyngealized especially by older speakers following the dorsal consonants and the glottal stop that marks a syllable break between /a/-/a/ sequence. [12] Pharyngealization of /a/ is more stylistic than phonemic.

(5) Stylistic pharyingealization of /a/ (emphatic speech)

/kaɲe/ 'having gone' [kaˤ.ʔaˤːɲɛ]

2.1.4 Vowel distribution

The table below shows the distribution of vowels in lexical roots. The vowel /a/ is the only one to occur in all positions without restrictions. No other vowel occurs root initially.

[12] Older speakers: those that are called /kewu/, more or less belonging to 50+ age group.

Table 2.2: Vowel Distribution in lexical roots

	single-vowel words	root initial	root medial	root final
i	+	-	+	+
e	+	-	+	+
ɯ	-	-	+	+
u	+	-	+	+
ɤ	-	-	-	+
o	+	-	+	+
a	+	+	+	+

2.1.5 Minimal Pairs

Contrasts among the vowels are shown in the minimal pairs below in word-medial or final positions.[13]

(6) /i/ vs /e/

a. /ɲi/ 3PL

/ɲe/ 'house'

b. /mimdzạ/ 'with a woman'

[13] There are no word-initial vowels except in the case of /a/ due to the 'no word-initial high vowels in syllables' rule.

/memdzᶎa/ ‘after a while’

(7) /i/ vs /ɯ/

a. /ɯʃi/ ‘leg’

/ɯʃɯ/ ‘blood’

b. /gitɯno/ ‘help to carry’[14]

/gɯtɯno/ ‘help to beat’

(8) /i/ vs /u/

a. /ɯmi/ ‘small’

/ɯmu/ ‘hair’

b. /ki-/ ‘touch’

/ku-/ ‘cook’

(9) /a/ vs /ɯ/

a. /hudza/ ‘bridge’

/hudzɯ/ ‘fish trap’

b. /kat͡ʃo/ ‘go.PERF’

/kɯt͡ʃo/ ‘quickly’

[14] Morphemes hyphenated to the right are verb roots which take some or the other morphemes depending on the context. The vowels immediately before the hyphen therefore always occur word medially.

(10) **/a/ vs /e/**

a. /aŋa/ ‘these many’

/aŋe/ ‘much’

b. /-wa/ IND marker

/-we/ IMPER marker

(11) **/a/ vs /o/**

a. /ba/ 2PL

/bo/ ‘money’

b. /tʂa-/ ‘leave’

/tʂo/ ‘yam’

(12) **/u/ vs /ɯ/**

a. /uʁu/ ‘salt’

/ʁɯ/ ‘ten’

b. /dʐu-/ ‘ripen’

/dʐɯ-/ ‘sell’

(13) **/o/ vs /u/**

a. /o/ ‘paddy’

/u/ ‘good’

b. /bolu/ ‘strong’

/bulu/ ‘worm’

(14) **/e/ vs /o/**

a. /he/ ‘this’

/ho-/ ‘see’

b. /melu/ ‘a silver ornament’

/molu/ ‘wait’

2.1.6 The vowel /ɤ/

The vowel /ɤ/ though frequently used, occurs in only three contexts. First, in /gɤ/ the locative morpheme; second, as an alternant of the word-initial /i/ in body part terminology;[15] third, in the diphthong-like /-ɤw/ which will be discussed in sec. 4.2.1.2. Although occurrence in limited contexts makes its phonemic status suspect, the proof is its contrast with the other vowels following /g/.

(15) Contrast between /ɤ/ and other vowels

a. /gɤ/ LOC

b. /go/ ‘from’

c. /gi-/ ‘carry’

d. /gu-/ ‘fill’

[15] See sec 4.1.2

e. /ga-/ ‘fall’

f. /ge/ ‘cloth’

g. /gɯ/ ‘beat’

Although this is the only environment where it contrasts with the other vowels, I am including it in the vowel inventory since the contrast in (15) cannot be explained by allophony. Given the vowel symmetry in

Figure 3, it is plausible that the vowel had been a more prominent part of the vowel inventory historically, but currently is on its way out.

2.1.7 Diphthongs

Hrusso Aka does not have diphthongs at the lexical level. A diphthong-like sequence [-ɤu] or [-ɤw] is formed at the word formation level. I shall interpret it as a vowel-glide sequence. An analysis of [-ɤw] sequence is given in sec.4.2.1.2. below.

2.2 Consonants:

Hrusso Aka has 26 consonants as listed in the table below. In this section I shall first list all the consonant phonemes under their traditional groupings as plosives, affricates, fricatives, nasals, liquids and glides, briefly describe their characteristics, and list minimal pairs.

2.2.1 Plosives

Hrusso Aka has three pairs of plosives: the voiceless and the voiced bilabial /p/ and /b/; the voiceless and the voiced dental /t/ and /d/ and the voiceless and the voiced velar /k/ and /g/. The voiceless plosives have the following allophones.

Figure 4: Hrusso Aka Consonants

	bilabial	*labio-dental*	*dental*	*alveopalatal*	*retroflex*	*velar*	*uvular*
stop	p b		t d			k g	
affricate				t͡ʃ d͡ʒ			
fricative		f v	s	ʃ ʒ	ʂ ʐ		χ ʁ
nasal	m		n	ɲ		ŋ	
lateral			l	ʎ			
rhotic			(ɾ)				
glide	w			j			

(16) Allophones of voiceless plosives

a. /t/ is obligatorily aspirated as [t^h] before the high vowels, and optionally elsewhere.

b. /p/ obligatorily affricated as [$p^ɸ$] before /u/; obligatorily aspirated as [p^h] before /i/ and /e/ and optionally aspirated elsewhere.

c. /k/ is obligatorily affricated before the high vowels as [k^x] and optionally aspirated elsewhere.

The process of voiceless plosive aspiration and affrication gives important insights into the Hrusso Aka phonology. This is discussed with examples in sec 4.3.6.

2.2.2 Affricates

Although /t͡ʃ/ and /d͡ʒ/ are phonetically affricates, they behave phonologically as plosives. As the consonant chart shows, they fill the plosive slot in the alveo-palatal series of consonants which also consists /ʃ/, /ʒ/, /ɲ/, /ʎ/ and /j/. [16]

2.2.3 Fricatives

The fricatives, which play a prominent role in Hrusso Aka phonology are, the labio-dentals /f/ and /v/, the uvular fricatives /χ/ and /ʁ/ and the sibilants. The sibilants are the dental sibilant /s/, the alveolar sibilants /ʃ/ and /ʒ/, the retroflex sibilant /ʂ/ and /ʐ/. The voiced dental sibilant is not found in the *Ĝuso* dialect. Interestingly, the presence of the retroflex sibilants is peculiar in what is otherwise a very systematic and symmetrical consonantal system. All the other sibilants have their corresponding plosive counterparts except the retroflex sibilants that stand alone, as can be seen in the consonant chart. The sibilants form two stop-sibilant consonant cluster series which play a very important role in the Hrusso Aka Phonology. I shall discuss these in chapter 6.

The labiodental fricatives and the sibilants do not show allophony, whereas the uvular fricatives have numerous allophones:

2.2.3.1 Allophones of /χ/[17]

(17) /χ/ is realized as a voiceless velar fricative [x] before the high vowels.

[16] See Lahiri-Reetz (2010 p. 46) for a discussion on palatal plosives realized as affricates.

[17] The rule formalism represented here is based on the FUL system and uses monovalent features. I shall explain this in the next chapter.

/χ/ → [x] /___ [VOC, HIGH]

(18) /χ/ is realized as a voiceless glottal fricative [h] before /a/.

/χ/ → [h] /___ /a/

(19) Free variation

/χ/ freely alternates as the velar fricative [x], the voiceless uvular fricative [χ], the voiceless [h] elsewhere.

2.2.3.2 Allophones of /ʁ/

(20) /ʁ/ is realized as a voiced uvular trill [ʀ] before the coronal vowels.[18]

/ʁ/ → [ʀ] /___ [VOC, COR]

(21) /ʁ/ is realized as a voiced uvular fricative [ʁ] before /u/.

/ʁ/ → [ʁ] / ___ /u/

(22) /ʁ/ is realized as a voiced velar fricative [ɣ] or a voiced uvular fricative [ʁ] before /ɯ/.

/ʁ/ → [ɣ]~[ʁ] / ___ /ɯ/

[18] Coronal vowels is the terminology I shall use to designate /i/ and /e/ in the feature system I use in this study. This is based on the FUL featural system of Lahiri colleagues (Cf. Lahiri & Reetz 2010), which I shall explain in the next chapter.

(23) /ʁ/ has two free alternants, as a voiced velar approximant [ɯ̞] or the a voiced pharyngeal fricative [ʕ] before /a/

$$/ʁ/ \rightarrow [ɯ̞]\sim[ʕ] \; / \; \_\_\_ \; /a/$$

2.2.4 Nasals

Nasals are the bilabial /m/, the dental /n/, the palatal /ɲ/, and the velar /ŋ/.

2.2.5 Liquids

Among liquids, only the laterals /l/ and /ʎ/ are part of the Hrusso Aka sound inventory. The rhotic flap/ɾ/ is shown in brackets since it is a recent addition[19] and occurs only in loanwords borrowed from Assamese, English or Hindi. The liquids too do not show allophony.

2.2.6 Glides

The glides that have phonemic status are the palatal /j/ and the labio-velar /w/. The latter has a limited distribution as can be seen in tables Table 2.3 and Table 4.12 below.

2.2.7 Contrasts

Following is a list of pairs, triplets or word-groups in Hrusso Aka showing minimal contrast between consonants.

[19] This is true only for the *Ĝuso* dialect. The *Hushin* dialect has had /ɾ/ for a longer time, and it is better incorporated in the phonemic system, probably under the influence of the neighbouring Nishi language which is contiguous to the *Hushin* speaking villages.

2.2.7.1 Labial Consonants

(24) **/p/ vs /b/ vs /m/**

/pa-/	‘get’
/ba/	2SG
/ma/	NEG

(25) **/f/ vs /v/**

/-fi/	CAP
/vi/	‘field’

(26) **/p/ vs /f/**

/pu/	‘wheat’
/fu/	‘meat’

(27) **/v/ vs /b/**

/vo/	‘swine’
/bo/	‘money’

(28) **/v/ vs /w/**

/ava/	‘rice’
/awa/	‘father.VOC’

2.2.7.2 Dental, alveolar and palatal consonants

(29) **/t/ vs /l/ vs /d/ vs /n/**

/ta-/	‘rear’
/la-/	‘bring’
/da-/	‘do’
/na-/	‘pain’

(30) **/t͡ʃ/ vs /d͡ʒ/ vs /t/ vs /d/**

/t͡ʃo/	call to some action (1SG.INCL)
/d͡ʒo/	2PL
/to/	‘that’
/do/	‘mouth harp’

(31) **/l/ vs /ɬ/**

/dale/	‘if done’
/daɬe/	‘having done’

(32) **/n/ vs /ɲ/**

/ana/	‘like this’
/aɲa/	‘so much’

2.2.7.3 Sibilants

(33) **/s/ vs /ʃ/ vs /ʂ/ vs /ʐ/ vs /ʒ/**

/sɯ/	'bamboo'
/ʃɯ/	'blood'
/ʂɯ/	'gold'
/ʐɯ-/	'(be)sharp'
/ʒ/	-

No minimal pair is found in the available data to contrast /ʐ/ vs /ʒ/, and both are quite limited in distribution in the corpus. On the surface they seem to be in complementary distribution since /ʐ/ is found preceding /a/ and /ɯ/ whereas /ʒ/ precedes /e/. However, these are listed as separate phonemes because they each participate separately in the obstruent-sibilant cluster formation to give two distinct sets of clusters (see sec. 6.2.1).

2.2.7.4 Velar consonants

(34) **/k/ vs /g/**

a. /kʲe/ when

b. /gʲe/cloth

(35) **/χ/ vs /ʁ/**

a. /uxu/ soup

b. /uʁu/ salt

(36) **/ɡ/ vs /ŋ/**

a. /ɡa-/ fall

b. /ŋa-/ become cold

(37) /ʁ/ vs /ɡ/

a. /ʁɯ-/ lie down

b. /ɡɯ-/beat

2.2.8 Consonant distribution

Table 2.3: Consonant distribution in words

	word initial	word medial	word final
p	+	+	-
b	+	+	-
t	+	+	-
d	+	+	-
k	+	+	-
g	+	+	-
t͡ʃ	+	+	-
d͡ʒ	+	+	-
m	+	+	+
n	+	+	-
ɲ	+	+	+
ŋ	+	+	-
f	+	+	-
v	+	+	-
s	+	+	-
ʃ	+	+	-
ʒ	+	+	-
ʂ	+	+	-
ʐ	+	+	-
χ	+	+	-
l	+	+	-
j	+	+	-
ʎ	+	+	+
w	-	+	-

The table above shows the consonant distribution in word initial, medial and final positions in words. Due to the preferred CV syllable structure in the language, only a few consonants, that is /m/, /ɲ/ and /ʎ/ are found word finally. At the lexical root level not even these consonants are found in the root-final position.

2.3 Some Problems in Phonemic Description

2.3.1 Residual Sounds

A common problem in the phonemic description of an unstudied language is that of the 'Pikean residues'(Pike 1947), those residual sounds which, at a particular stage of analysis, do not seem to fit into the phonemic system of a language. Pikean residues are often like parts of a jigsaw puzzle, and most of them eventually fit into the system with more data and better analysis. One such sound is /h/ which turned out to be an allophone of /χ/. Another pair is /ʒ/ and /ʐ/, both of which have been analyzed as independent phonemes based on indirect evidence. The vowel /ɤ/ has been a great tormentor since the beginning, and I have assigned an independent phonemic status to it with some hesitation.

There is another sound whose phonemic status is not clear; the nasalized vowel as in the following words:

(38) Nasalized vowel

a. /tɯfã/ a proper name

b. /kadã/ 'become.PERF'

c. /ugõ/ 'cost'

The diphthong-like /-ɤw/ is another entity with unclear status as I have noted above. It behaves both like a diphthong [-ɤu] and like a CV sequence [-ɤw]. Since its status is not clear at the moment, I have not included [w] as a possible coda sound in the discussion on syllable structure below.

2.3.2 The problem of phonemic choice

When the researcher is faced with allophones during analysis, he has to choose one of them as the representative allophone. As Wiese (1996 p. 16) notes, this is not always a simple choice. Naming a phoneme and assigning a symbol to it is an action that has implications for orthography and how the sound will be perceived in future. A researcher may be playing a part in sound change just by the act of pinning down a phoneme to a category, therefore, very careful consideration is due in this choice.

In Hrusso Aka, representation of certain phonemes has been problematic. For example, /ʁ/ the voiced velar fricative and its voiceless counterpart /χ/ have many allophones. They are realized as velar, uvular, glottal or pharyngeal fricatives. /ʁ/ is even realized as a trill and an approximant as seen above. The older speakers of the *Ĝuso* dialect in fact mostly push them backwards (uvular-pharyngeal-glottal) and younger speakers prefer them as fronted (velar-uvular). Thus I have been forced to make a choice among equally preferable alternatives. This makes both the symbols and their labels arbitrary in some sense.

2.4 Conclusion

The purpose of this chapter was to gain an overall understanding of the vowel and consonant system of Hrusso Aka. In the following chapters I shall discuss these vowels and consonants combine to form the Hrusso Aka phonological system.

Chapter 3. Feature Analysis

3.0 Introduction

In this chapter I discuss the feature system of Hrusso Aka using the Featurally Underspecified Lexicon (FUL) model. The first section of the chapter is a brief introduction to the feature theory. In the second section I discuss the FUL model especially highlighting its aspects that are important for this study. In the third section I explore the featural system of Hrusso Aka using the FUL framework.

3.1 The Distinctive Feature Theory

The distinctive feature theory (Jakobson et al. 1952) proposed that each sound segment of a given language is composed of a set of distinctive features as opposed to the 'atomic' view prevalent at the time, which held that phonemes are indivisible phonological units of a language. Phonemes were, in Bloomfield's (1935) terminology, 'feature bundles', a sum total of features that could be represented as feature matrices but with no matrix-internal organization or hierarchy. The feature matrix, or the feature column, was also thought to be a linear phenomenon that is, there was thought to be a bijective (one-to-one) relationship between a phoneme and its feature matrix. In other words feature bundles were arranged in a linear succession just like their corresponding phonemes. A feature matrix corresponding to a phoneme was a closed system and did not 'communicate' with neighbouring feature matrices. The features were represented with the binary '+' or '-' values indicating their presence or absence.

As Clements and Hume (1995) point out, this simple model, or 'matrix formalism' as it came to be known, afforded elegant ways of mathematical representation and manipulation of features for speech modelling and synthesis. Using matrix formalism the distinctive feature theory was able to successfully explain linguistic phenomena like language acquisition, historical sound change and language disorders.

Chomsky & Halle's *Sound Patterns of English* (1968 - henceforth *SPE*) succeeded in elegantly applying the distinctive feature theory to English phonology using matrix formalism and had a great influence on subsequent phonological research. However, the distinctive feature system proposed in *SPE* differed from Jakobson's model in some important respects. First of all, in the Jakobsonian system features were defined primarily on acoustic properties whereas *SPE*'s features were based on articulatory factors. Second, the features proposed by Jakobson et al. were applicable to both vowels and consonants whereas *SPE* used different sets of features for these (Ewen & Hulst 2001 p. 8).

As research in phonological theory progressed, problems with *SPE*-type matrix formalism became evident. Two major inadequacies were highlighted by various researchers (Cf. Clements 1985; Sagey 1986; McCarthy 1988). First, in the supposed bijective relationship between phonemes and their features, the featural domain was exactly one phoneme. This failed to explain phenomena such as feature spreading and floating tones (Goldsmith 1976; Pulleyblank 1986). Second, since the model did not propose any phoneme-internal feature organization, it was implied that features were equidistant from one another. This could not account for the data where features seemed to be acting in systematic groups. For example, in the dialects of English where /t/ is replaced by glottal stop in words like [bʌ^{ʔ}n̩] 'button' the oral features disappear as a group, but the laryngeal feature is left intact.

Similar is the case certain dialects of Spanish where only the laryngeal feature, aspiration, is left behind and the oral features are lost as a group when /s/ is replaced by /h/ in the syllable coda in words like *mismo* [mi^{h}mo] 'same' (Clements & Hume 1995 pp. 248–9).

Non-linear phonology, in a response to such problems posited that features do not occur as random 'bundles', but are arranged in tiers that are capable of independent movement across phonemic boundaries. Further in order to explain the group-behaviour of features, Clements (1985) and Sagey (1986) proposed models of hierarchical feature organization that came to be known as feature geometry. In these models segments are not represented as matrices, but as hierarchically organized node configurations. A node stands for a constituent in the hierarchy where features that consistently act together as units in phonological processes are grouped together. Featural values are represented at the terminals with their binary values.

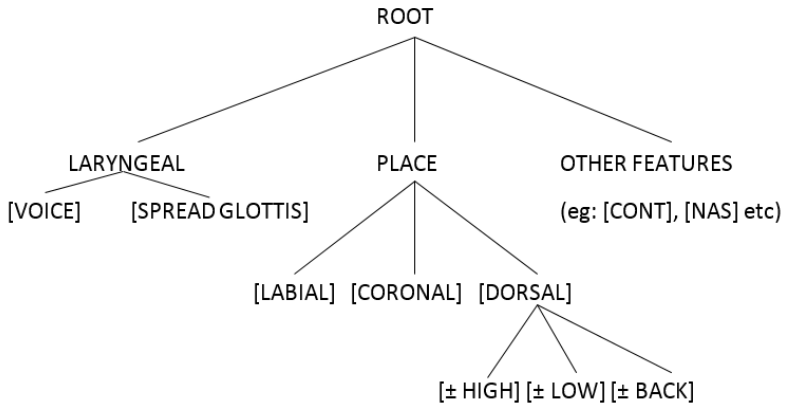
Since the concept of feature geometry emerged, various models have been proposed as to the hierarchical organization of phonological features. I shall briefly survey four such models here in order to trace the most recent developments.[20]

Articulator Theories (AT), based on Sagey (1986), and further modified by Halle (Halle 1988, 1992, 1995) organize the feature hierarchy according to the anatomical properties of the articulators. They make a clear-cut distinction between the non-terminal tree 'nodes', on one hand, and terminal 'features' on the other. In this model, as shown in

[20] The following section, up to the description of FUL, is essentially a summary of (Lahiri & Reetz 2002, 2010).

Figure 5 below, vowels and consonants are grouped under separate place nodes. Vowels are distinguished with the features retained from *SPE,* namely, [± HIGH], [± LOW] and [± BACK], and grouped under [DORSAL] node. Consonants on the other hand, are placed under the [LABIAL], [CORONAL] and [DORSAL] nodes; the coronals are further distinguished with [± ANTERIOR] and [± DISTRIBUTED] terminal features. A crucial difference between Jakobsonian model and Halle-Sagey model is that the former grouped front vowels and the 'front' consonants[21] together with the feature *acute*, whereas the latter segregated them with completely different sets of features.

Figure 5: The Halle-Sagey feature geometry[22]

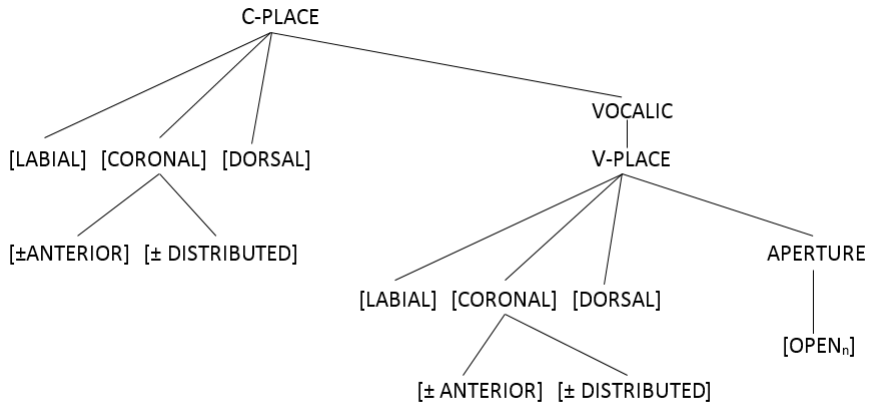


Clements and Hume (1995) pointed out the inadequacy of the Halle-Sagey model in explaining vowel-consonant interaction at the place of articulation and scalar assimilation of vowel height (Halle 2000 p.399) and proposed the Unified Feature Theory[23] (UFT). Clements (Clements 1989; Clements & Hume 1995) argued that, based on the degree and location of vocal tract constriction, vowels and consonants could share the same place

[21] That is, dental, alveolar and postalveolars consonants.
[22] From (Lahiri & Reetz 2010 p. 45)
[23] Terminology as in Halle et al. (2000)

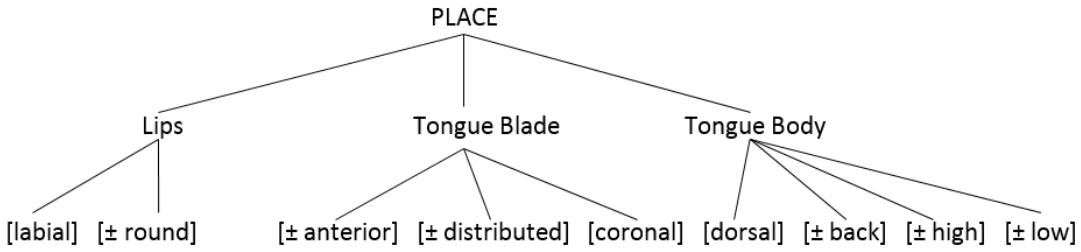
features. In the feature geometry proposed under this model, the consonants and vowels are kept separate on the feature tree, but have the same place nodes and terminal features. Consonants are placed under the C-Place node and Vowels were placed under V-Place node; the latter is dominated by the [VOCALIC] node, which in turn is placed under the C-Place node. Constriction for consonants is represented by the oral cavity node and degree of constriction, by the [± CONTINUANT] feature. Constriction for vowels is represented by the vocalic node, and degree, by the aperture node dominating [± OPEN]. Apart from the organization of the feature tree, another important difference between AT and UFT is that the latter replaces [± BACK] with [CORONAL] for vowels.

Figure 6: Feature tree based on Clements and Hume (1995)



Halle *et al*. (2000), in their Revised Articulator Theory (RAT), responded to the issues raised by Clements and Hume, and proposed that the features [HIGH], [LOW] and [BACK] be freed from their dependency on [DORSAL], and rejected UFT proposal for the unification of vowel and consonant features.

Figure 7: Feature organization based on Halle et al. (2000)



3.2 The FUL Model

Based on Clements' UFT, Lahiri and colleagues further argued, based on psycholinguistic evidence, for the unification of the vowel and consonant features but said that the separation between C-Place and V-Place is unnecessary. Reverting to the Jakobsonian sense of featural unity, they developed what is known as the Featurally Underspecified Lexicon (FUL) model (Lahiri & Evers 1991; Ghini 2001; Lahiri & Reetz 2002, 2010).

The FUL model is a representation of feature organization that "makes precise predictions about the nature of phonological representations and mapping algorithms from surface to underlying mental representation." (Lahiri & Reetz 2010 p. 44). It sets out to answer two basic questions in Phonological Theory. First, what is the algorithm for matching the underlying representations and the surface forms? Second, how, in spite of the variations in acoustic signals, speech sounds are recognized for what they are? In other words, what is the process involved in the production and comprehension of speech sounds, whereby

relevant information is produced by the speaker and extracted by the listener in spite of the variability of acoustic signals?

In answering the first question, the basic tenet of FUL model is that lexical entries are stored in the brain in the form of featurally underspecified morphemes. This is opposed to the view that there is one, unique, fully binary-specified underlying representation, and its surface form is a result of the interaction between constraints and phonological rules in the language. For example, in German, /hʊnd/ 'dog', would be the unique underlying representation, whereas [hʊnt] and [hʊnde] are its two surface forms. The final consonant devoicing rule has applied in the case of the former, changing [d] to [t], but not in the case of the latter, since it is not a final vowel. FUL, in explaining how the two surface forms are able to tap the same underlying representation, opposes such a traditional view and holds that /d/ in /hʊnd/ is underspecified for [PLACE] and [VOICE] features. (Lahiri & Reetz 2010).

In mapping the relationship between the surface expressions and the underspecified underlying forms the FUL model adopts the feature geometry as represented in the figure below.

3.2.1 Salient Aspects of the FUL model

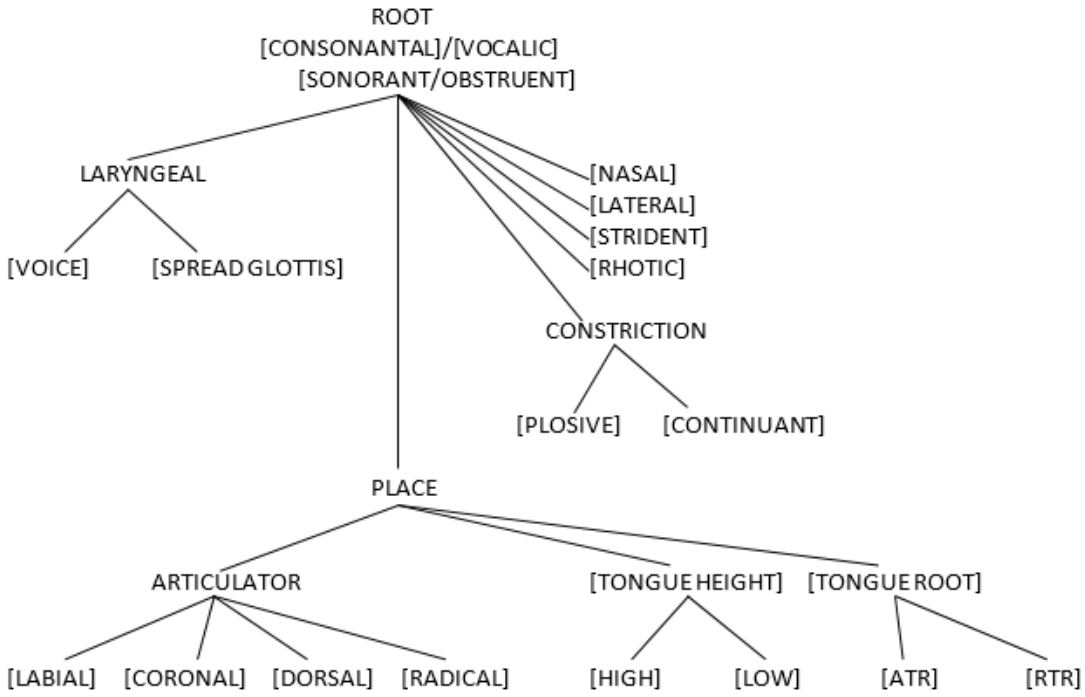
In this section I survey the most important aspects of the FUL model that are relevant for this study.

3.2.2 Privative Features

The FUL model departs from the traditional representation of features as binary and adopts univalent or privative features advocated by Sagey (1986) and Clements & Hume

(1995) with modification. Whereas these authors maintain that the terminal features are binary, the FUL model discards the terminal binary features altogether.

Figure 8: FUL feature tree (Lahiri & Reetz 2010)



The only binary features allowed in FUL model are at the root node, and they are [CONSONANTAL]/[VOCALIC] and [OBSTRUENT]/[SONORANT]. These are mutually exclusive pairs - either one or the other must be present - and therefore, can always be expressed by mentioning the feature itself without having to resort to the negative value of the opposite feature. Added to these, features such as [HIGH] and [LOW] are mutually exclusive too, but there is no binary relationship between them, since a sound segment may be neither, which

happens when tongue height is not specified for a particular segment. Thus no features are expressed with negative values (eg. [-LOW]) in FUL. This is not only a matter of convention, but also due to the fact that the model holds that negative features are not extracted by the human brain, and therefore, do not play any role in speech production or comprehension.

3.2.3 Unified Vowel and Consonant Features

As mentioned above, the FUL model posits the same set of features for both vowels and consonants. In this system, the place of articulation determines the horizontal dimension on the vocal tract whereas tongue height, or the aperture node, determines the vertical. Both the nodes are dominated by the place node.

Consequently, the vowel-specific feature [± BACK] of the earlier systems is discarded from the feature inventory altogether. The [DORSAL], [CORONAL] and [LABIAL] features are placed under the articulator node, and [HIGH] and [LOW] under the [TONGUE HEIGHT] node and are applicable to both vowels and consonants.

There is a caveat though. The features [DORSAL] and [CORONAL] can co-occur with [LABIAL] only in the case of vowels and the labio-dorsal glide [w], but not consonants. Thus [o] can be [CORONAL, LABIAL], but /p/ [LABIAL] mismatches /k/ [DORSAL].

3.2.4 Specification of Features

The FUL model is a system where underspecification plays a major role as explained above. Feature specification is thought to be necessary only if there is a need to establish a phonemic contrast. For example, [VOICE] is represented only if there is a voicing contrast in a language. Following the FUL model, I shall represent the featural representations for

Hrusso Aka as monovalent, and specify them only when they participate in a phonemic contrast.

3.2.5 Features and Segments

Following is a list of features and the segments that they specify.[24]

Table 3.4: Features and Segments

[LABIAL]	labial consonants, rounded vowels.
[CORONAL]	front vowels, dental, palatal, palatoalveolar, retroflex consonants.
[DORSAL]	back vowels, velar, uvular consonants.
[RADICAL]	pharyngealized vowels, glottal, pharyngeal consonants.
[HIGH]	high vowels, palatalized consonants, retroflex, velar, palatal, pharyngeal consonants, glides.
[LOW]	low vowels, dental, uvular consonants.
[ATR]	palatoalveolar consonants.
[RTR]	retroflex consonants.

3.3 Featural specification of the Hrusso Aka vowels and consonants

3.3.1 Vowels

The seven vowels in Hrusso Aka can be featurally represented using the features on the basis of their height, place of articulation and labiality as shown in the table below:

[24] As in Lahiri & Reetz (2010 p. 46), reproduced with permission.

Table 3.5: Vowel features

	[VOC]	[HIGH]	[LOW]	[COR]	[DORS]	[LAB]
/i/	✓	✓		✓		
/ɯ/	✓	✓			✓	
/u/	✓	✓			✓	✓
/e/	✓			✓		
/ɤ/	✓				✓	
/o/	✓				✓	✓
/a/	✓		✓			

In the table vowel /a/ is specified for only two features namely [VOCALIC] and [LOW]. First of all, since no negative features are represented in the FUL model, the unrounded nature of the vowel, which is the unmarked status of a vowel, cannot be represented as [-LABIAL]. Secondly, there is no need to specify the [DORSAL] feature sine there is no contrast involving this feature with any other vowel.

In the binary system the close-mid vowels (or simply, mid vowels) would be represented as $\begin{bmatrix}\text{-LOW}\\ \text{-HIGH}\end{bmatrix}$, but in the FUL system, the lack of negative features means that they are left unspecified for height for the reasons explained above, that is, the brain can extract only the features [HIGH] and [LOW] from the vowel system, and when these features are

absent, the vowels are automatically perceived as neither, that is, the mid vowels. Below is the full featural representation of the seven vowels.[25]

(39) High vowels

/i/ [VOC, HIGH, COR, ATR] /ɯ/ [VOC, HIGH, DORS] /u/ [VOC, HIGH, DORS, LAB]

(40) Mid vowels

/e/ [VOC, COR] /ɤ/ [VOC, DORS] /o/ [VOC, DORS, LAB]

(41) The low vowel

/a/ [VOC, LOW]

3.3.2 Consonants

Based on the FUL feature tree (Figure 8), I shall now motivate the features for the Hrusso Aka consonantal system.

3.3.2.1 Major class features

All consonants have the specification [CONSONANTAL] which distinguishes them from vowels. Laterals, nasals and glides are distinguished as [SONORANT] from plosives and fricatives which are [OBSTRUENT].

[25] The high vowel /i/ is also specified for [ATR], but it is not clear if, conversely /ɯ/ is [RTR]. Therefore, I shall not specify the tongue root feature here. The [ATR] feature of /i/ participates in a coronal CV sequential rule as explained in sec. 4.2.4.

Table 3.6: Major Class Features

	[CONS]	[SON]	[OBS]	[NASAL]	[LATERAL]
stops	✓		✓		
fricatives	✓		✓		
nasal	✓	✓		✓	
laterals	✓	✓			✓
glides	✓	✓			

3.3.2.2 Laryngeal features

Only obstruents are specified for voice features. Other consonants are all sonorants, which are voiced by default, and therefore, do not require the specification of [VOICE]. Voiced obstruents are marked with [VOICE], and the voiceless obstruents are specified for [SPREAD GLOTTIS] (henceforth [SG].). The opposition [VOICE] vs [SG] is not due to voice-voiceless contrast – for in that case the voiceless consonants would be left unspecified for [VOICE] feature – but it originates due to the fact that all voiceless obstruents are aspirated.

Table 3.7: Laryngeal features of Obstruents

	[VOICE]	[SG]
voiced stops	✓	
voiceless stops		✓
voiced fricatives	✓	
voiceless fricatives		✓

3.3.2.3 Place features

The articulator node classifies the consonants into three groups according to the features [LABIAL], [DORSAL] and [CORONAL]; the feature [RADICAL] is not used.

[LABIAL] /p, b, f, v, m/

[DORSAL] /k, g, χ, ʁ, ŋ/

[CORONAL] Dentals: /t, d, s, l, n /; Palatals / alveopalatals: / t͡ʃ, d͡ʒ, ʃ, ʒ, ʎ, ɲ, j/

Retroflex: /ʂ, ʐ/

3.3.2.4 Labials

Each of the labial consonants are represented in the table below, with full specifications that distinguish each from all the other segments in Hrusso Aka:

Table 3.8: Feature specification for the labial consonants

	[CONS]	[LAB]	[OBST]	[PL]	[SON]	[VOICE]	[SG]	[CONT]	[NAS]
p	✓	✓	✓	✓			✓		
b	✓	✓	✓	✓		✓			
f	✓	✓	✓				✓	✓	
v	✓	✓	✓			✓		✓	
m	✓	✓			✓				✓

3.3.2.5 Dorsals

The dorsals are listed in the table below, again, with the feature specifications that distinguish each of them from all the others.

Table 3.9: Feature specification for the dorsal consonants

	[CONS]	[DORS]	[OBST]	[PL]	[SON]	[VOICE]	[SG]	[CONT]	[NAS]
k	✓	✓	✓	✓			✓		
ɡ	✓	✓	✓	✓		✓			
χ	✓	✓	✓				✓	✓	
ʁ	✓	✓	✓			✓		✓	
ŋ	✓	✓			✓				✓

3.3.2.6 Coronals

The FUL model says that since the coronals are underspecified for [PLACE] feature there are no further place divisions within coronals, that is, [ANTERIOR] and [DISTRIBUTED] are not used. Instead, they are distinguished from each other on the basis of tongue height [HIGH], [LOW]; and tongue root [ATR], [RTR] features. The following table shows this distinction.

Table 3.10: Feature specification for the coronal consonants

	[CONS]	[COR]	[HIGH]	[STRI]	[RTR]	[OBST]	[PL]	[SON]	[VOICE]	[SG]	[CONT]	[LAT]	[NAS]
t	✓	✓				✓	✓			✓			
d	✓	✓				✓	✓		✓				
s	✓	✓		✓						✓	✓		
n	✓							✓					✓
l	✓	✓						✓				✓	
t͡ʃ	✓	✓	✓			✓	✓			✓			
d͡ʒ	✓	✓	✓			✓	✓		✓				
ʃ	✓	✓	✓	✓						✓	✓		
ʒ	✓	✓	✓	✓					✓		✓		
ɲ	✓	✓	✓										✓
ʎ	✓	✓	✓					✓				✓	
j	✓	✓	✓					✓					
ʂ	✓	✓		✓	✓					✓	✓		
ʐ	✓	✓		✓	✓				✓		✓		

3.3.2.7 Redundancy relationships

Note that in the above table the stridents are not specified for [OBS] due to the dependency relationship [STRI] => [OBS]. Likewise, the nasals are not specified for [SON] due to the dependency [NAS] => [SON] (Lahiri & Reetz 2010 p. 46). These two are universal redundancies. In Hrusso Aka more such redundancy relationships are operative. They are listed below:

(42) Redundancy relationships

a. [NASAL] => [SONORANT]
b. [OBSTRUENT] => [CONSONANTAL]
c. [STRIDENT] => [OBSTRUENT]
d. [PLOSIVE] => [OBSTRUENT]
e. [CONT] => [OBSTRUENT]
f. [LATERAL] => [SONORANT]
g. [SONORANT] => [VOICE]
h. [LAT] => [CONSONANTAL]

It is sufficient to specify the left hand side value of the dependency relationship in featural representation, since the right hand side value is implied. The example below shows the featural specifications for the alveolar lateral /l/ before and after applying the redundancy rules.

(43) a. full featural specification: /l/ $\begin{bmatrix} \text{CONS} \\ \text{VOICE} \\ \text{SON} \\ \text{LAT} \\ \text{LOW} \end{bmatrix}$

b. featural specification after applying redundancy rules: $\begin{bmatrix} \text{LAT} \\ \text{LOW} \end{bmatrix}$

The feature [LAT] automatically implies the unmentioned features according to the redundancy relationships listed 480 above, that is, [LAT] => [SON] => [VOICE] and [LAT] => [CONS]. The feature [LOW] needs a mention due to the contrast between /l/ $\begin{bmatrix} \text{LAT} \\ \text{LOW} \end{bmatrix}$ and /ʎ/ $\begin{bmatrix} \text{LAT} \\ \text{HIGH} \end{bmatrix}$. The following chart shows the entire consonantal feature system of Hrusso Aka after the application of the redundancy rules.

Table 3.11: Consonant features

	ROOT																
											PLACE						
							LARYNG		CONSTRCTN		ARTICULATOR			T.HEIGHT		T.ROOT	
	CONS	OBST	STRID	SON	NAS	LAT	VOICE	SG	PLOS	CONT	LAB	COR	DORS	HIGH	LOW	ATR	RTR
p		✓						✓	✓		✓						
b		✓					✓		✓		✓						
t		✓						✓	✓			✓			✓		
d		✓					✓		✓			✓			✓		
t͡ʃ		✓							✓			✓		✓			
d͡ʒ		✓					✓		✓			✓		✓			
k		✓						✓	✓				✓				
g		✓					✓		✓				✓				
f		✓						✓		✓	✓						
v		✓					✓			✓	✓						
s			✓					✓				✓			✓		
ʃ			✓									✓		✓		✓	
ʒ			✓				✓					✓		✓		✓	
ʂ			✓					✓				✓		✓			✓
ʐ			✓				✓					✓		✓			✓
χ		✓						✓		✓			✓	✓			
ʁ		✓					✓			✓			✓	✓			
l						✓											
ʎ						✓											
m	✓				✓						✓						
n	✓				✓										✓		
ɲ	✓				✓							✓		✓			
ŋ	✓				✓								✓	✓			
w	✓			✓							✓		✓	✓			
j	✓			✓								✓		✓			

3.3.2.8 Featural specification some segments.

The examples below illustrate the feature matrices of some Hrusso Aka consonants.

(44) Feature matrices of some consonants

	full specification	**after applying redundancy rules**
a.	/p/ [CONS, OBS, SG, PL, LAB]	/p/ [PL, SG, LAB]
b.	/ʁ/ [CONS, VOICE, OBS, CONT, DORS]	/ʁ/ [CONT, OBST, DORS]
c.	/ʂ/ [CONS, SG, CONT, STRI, COR, RTR]	/ʂ/ [STRI, SG, COR, RTR]
d.	/ɲ/ [CONS, NAS, HIGH, COR]	/ɲ/ [NAS, COR, HIGH]

The minimally specified features on the right alone are sufficient to distinguish every segment from all the others in the language. This is illustrated in the following example:

(45) Showing featural contrast in /k/ and /g/ and /s/ using minimal feature specification.

/k/ [PL, SG, DORS] /g/ [PL, VOICE, DORS] /s/ [STRI, SG, COR, LOW]

This shows that /k/ and /g/ contrast only in laryngeal features [SG] and [VOICE], and they differ from /s/ in [CONSTRICTION] and [PLACE] features.

3.4 Conclusion

The featural representations given here show all and the only featural specifications required to distinguish each segment from all the others. The feature system in the FUL framework thus gives each segment a unique featural identity using minimal features. I shall show in the following sections that these featural specifications effectively explain the morpho-phonological processes in Hrusso Aka.

Chapter 4. Some Morpho-phonological Processes

4.0 Introduction

In this chapter I discuss some important phonological processes in the light of the featural analysis in the last chapter. This chapter has three sections. The first section consists of a discussion on word-initial vowels. It shall show that except /a/, no vowels are allowed word-initially at the lexical root level, and that words beginning with other vowels are bi- or poly-morphemic. I also discuss the interesting morpho-phonological phenomena of kinship and body part terminology, especially vowel harmony in the latter. The second section will involve a discussion on the phonotactic constraints on vowel sequences, like the V.V sequence prohibition. In the third section I investigate high vowel devoicing and offer a plausible hypothesis based on the feature analysis developed above.

4.1 Word Initial vowels and Vowel Harmony

Word-initial vowels are generally disfavoured in Hrusso Aka; there are only small sets of words beginning with vowels. It may be recalled here, from Table 2.2, that at the root level only the low vowel /a/ can occur word initially.[26]

4.1.1 Words beginning with /a/

(46) Words beginning with /a/

a. /apu/ ‘milk’

b. /aʂa/ ‘cat’

[26] That is, excluding stand-alone vowels.

c. /aɲa/ ‘this much’

Besides these, many kinship terminology words begins with the vowel /a/.

(47) Kinship terminology

a. /aye/ ‘elder brother’

b. /ama/ ‘elder sister’

c. /awu/ ‘father

d. /aɲ/ ‘mother

e. /aki/ ‘uncle

f. /atʂu/ ‘aunt’

It is interesting that both kinship and body part terminology, which are frequently classified under nouns with inalienable possession in languages of the world (Siewierska 2013 p. 337), begin with vowels in Hrusso Aka, going against the preferred syllable structure CV. A morphological analysis of these words suggests that they are bimorphemic in the underlying representation. In body part terminology this is quite clear, whereas in kinship terminology it is more obscure.

A comparison with other languages in the region gives some insight into the bimorphemic origin of kinship terminology. In Hrusso Aka the present kinship terminology does not have inalienable possession. For example,

(48) /awu/ ‘father’

(49) /no awu/ ‘my father’

However, in Angami, a Tibeto-Burman language spoken in Nagaland, kinship terminology is marked with inalienable possession[27].

(50) Inalienable possession marking in Angami

a. apuo ‘my father’

b. npuo ‘your father’

c. *puo ‘father’[28]

Thus a plausible explanation for the Hrusso Aka kinship terminology beginning with the vowel /a/ is that these words were historically marked inalienable possession. The vowel /a/ might have been one of the markers in a specific context (say 3SG in an earlier form of this morpheme, but which is /i/ at present). The inalienability is lost now, but the vowel, has stayed put.

4.1.2 Body Part Terminology

Inalienable possession is clearer in body part terminology. It appears that the 3rd person marker /i/ is the origin of inalienable possession. Body part terminology begins with the vowels [ɯ], [i], [e], [ɛ], [ɤ], [u], and rarely [o]. The words are made up of two morphemes as shown below:

(51) Bimorphemic nature of body part terminology

/i/ 3SG (?) + [kʲetʂɯ] ‘hair’ → [ikʲetʂɯ] ‘his hair’ or ‘hair’

[27] From personal knowledge. Many related languages like Mao, Poumai, Chakri etc. too have kinship terminology with inalienable possession marking.

[28] This form is used rarely, only in translated prayer texts in church, but not in natural language.

Evidence for the bimorphemic origin of body part terminology comes from the fact that [ikʲetʂɯ] can be understood both as ‘his hair’ or ‘hair’, but /kʲetʂɯ/ means only ‘hair’. The fact that /ikʲetʂɯ/ also means ‘hair’ in spite of the 3SG marker, indicates that the loss of inalienable possession is underway.

4.1.3 Vowel Harmony

Body part terminology is of special interest due to the vowel harmony. Below is a broad phonetic transcription of some words from body part terminology.

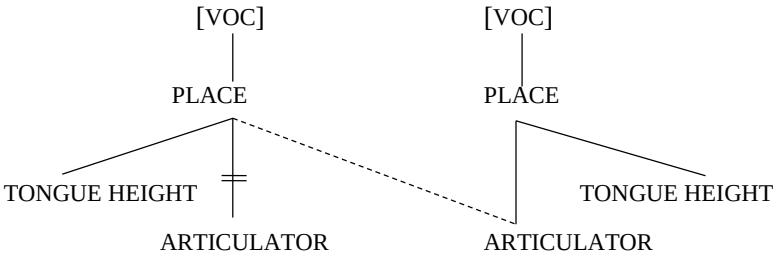
(52) Body part terminology

a.	[ɛkʰʲɛnɖʐo]	‘forehead’	
b.	[iɲi]	‘eye’	or [ɛɲi]
c.	[unʃu]	‘nose’	
d.	[unzu]	‘lip’	
e.	[utʰu]	‘tooth’	
f.	[ɛʒebla]	‘tongue’	
g.	[ɤgaɖʐo]	‘chin’	or [ɯgaɖʐo]
h.	[upʰostu]	‘shoulder’	or [opʰostu]
i.	[ɤgʒɯkʰu]	‘palm’	or [ɯgʒɯkʰu]
j.	[ɯɖʐɯ]	‘liver’	
k.	[ɯmɯgi]	‘kidney’	or [ɤmɯgi]
l.	/udum/	‘throat’	

This data indicates that the first vowel takes on the place features of the immediately following vowel due to the spreading of the articular node as shown below. This means that

[LABIAL], [DORSAL] and [CORONAL] features are spread to the first vowel. The tongue height feature however, remains unspecified both before and after vowel harmony. This is attested by the fact that [ɯ] and [ɤ] are in free variation. Only the initial vowel is affected by the vowel harmony. All other vowels in the second morpheme remain intact.

(53) Vowel harmony in body parts terminology



4.1.4 Words beginning with /o/

I have argued that the only vowel-initial morphemes allowed at the root level are those beginning with /a/. Other vowel-initial words are bimorphemic. There are a small number of words in Hrusso Aka that begin with /o/, but they are bimorphemic.

(54) Words beginning with /o/

a. /o/ ‘paddy’

b. /olɯgɯ/ ‘rice’

c. /odʒe/ ‘bread’

d. /odʒʲe/ ‘year’

The first part of these words are derived from the lexical root /o/ ‘paddy’.[29]

(55) /olɯgɯ/ = /o/ ‘paddy’ + lɯgɯ ‘grain’ lit. ‘paddy grain’ = rice.

(56) /odʒe/ = /o/ ‘paddy’ + /dʒew/ ‘roll in to bread shape’ = ‘paddy which is rolled into bread shape’.

(57) /odʒʲe/ = /o/ ‘paddy’ + /dʒʲew/ ‘fruition’ = paddy fruition time (i.e., one year).

In conclusion to this section on word-initial vowels, it may be noted that that only /a/ is allowed in the initial position of an underived word or a root in Hrusso Aka (with the exception of the stand-alone single vowel words). Among the derived words beginning with vowels, the body part terminology is an interesting case due to its vowel harmony. Body part terminology is also typologically interesting because the language seems to be in the process of losing its earlier form of inalienable possession.

4.2 Vowel sequences

4.2.1 V.V sequence prohibition

No vowel sequence *V.V is allowed across syllable boundaries within a phonological word. Note that the second vowel in a potential V.V sequence will always by /a/, /o/ or /ɯ/ since only these occur derived-morpheme initially. Any V.V sequence is resolved by glide formation, vowel deletion or vowel merger.

[29] The only word beginning with /o/ but is not connected to paddy is /osa/ ‘duck’. However, since /sa/ means ‘young one’, /osa/ ‘duck’ seems to be bimorphemic too. Meaning of the fist part of the word, /o-/ is not clear as of now.

4.2.1.1 Glide Formation

(58) **Rule**: When the high vowels /i/ and /u/ are followed by the low vowel /a/ across syllable boundaries, a glide is inserted between the two vowels.

$$\emptyset \rightarrow \begin{bmatrix} \text{CONS} \\ \text{SON} \\ \text{HIGH} \end{bmatrix} \quad / \quad \begin{bmatrix} \text{VOC} \\ \text{HIGH} \end{bmatrix} \_\_ \begin{bmatrix} \text{VOC} \\ \text{LOW} \end{bmatrix}$$

$$[\alpha\text{PLACE}] \qquad\qquad [\alpha\text{PLACE}]$$

(59) /i/ '3SG' + /aɲ/ 'mother' → /i.jaɲ/ 'his/her mother/

(60) /ahu/ 'remote past' + /a/ 'one' → /a.hwa/ 'once upon a time'[30]

This rule is blocked or differently expressed when it leads to ill formed syllables or lexical clash.[31]

(61) /fu/ 'hundred/ + /a/ 'one' → [fu.ʔa] or[fu. ɯa] but not *[fuwa] perhaps because it clashes with *fu-wa!* 'it's a bull!'.

4.2.1.2 [DORSAL] feature spreading during nominalization.

When the nominalizing suffix /-w/ is suffixed to a verb root, the final vowel of the root is dorsalized, provided it is not a high vowel.

(62) [da] 'do' + [-w] 'NOM.suffix' → [dɤw]

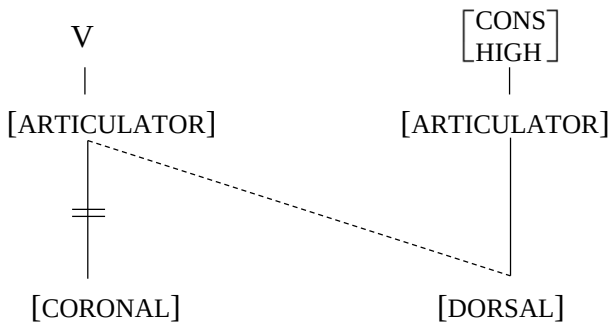
(63) [bʲe-] 'shoot' + [-w] → [bʲɤw]

(64) [ʃo-] 'smell' + [-w] → [ʃow]

[30] The syllable division here is not clear from the available data. Two native speakers tend to syllabify it as /a.hwa/ but the data is limited and more investigation is needed. I have disregarded this in the discussion on syllabification in the next chapter.

[31] "Ill-formed syllable": see the next chapter.

The process can be represented as below for the coronal vowel /e/.



The low vowel /a/ undergoing this process loses the feature [LOW] when it acquires the feature [DORSAL] and becomes [ɤ]. Thus the contrast between /e/ and /a/ is neutralized when followed by the [-w] morpheme.

The exemption of high vowels from the rule is illustrated in the following examples:

(65) /gi-/ 'carry' + /-w/ NOM.suffix → /giw/

(66) /gɯ-/ 'beat' + /-w/ → /gɯw/

4.2.2 Glottal stop insertion

All other V-V sequences across morpheme boundaries that fail to undergo these processes, due to lexical conflict or any other reason, are kept separate in separate phonological words, or, if there are in the same word, separated by an obligatory glottal stop.

(67) /ma/ NEG + /u/ 'good' → [ma.ʔu] 'bad'

(68) /ba/ 'your' + /iŋ/ 'eye'→ [ba] [ʔiŋ] 'your eye' (Here the dropping of the body part morpheme (see 4.2.3 below) is blocked in order to avoid lexical conflict with [baŋ] 'your mother')

4.2.3 Vowel or morpheme deletion?

There is a morphological process that looks like a vowel deletion rule, but is in fact a morpheme deletion process, applying purely at the morphological level. When a body part word concatenates with a pronoun, the initial vowel of the body part word is deleted.

(69) Initial vowel deletion in body part words?

a. /ba/ 'your' + /ɯgʒɯ/ 'hand' → /bagʒɯ/ 'your hand'

b. /no/ 'my' + /uluhudzɻɯ/ 'stomach' → /noluhudzɻɯ/ 'my stomach'

In the light of the analysis of body part terminology in sec .4.1.2 above, it is the initial morpheme of the body part terminology that is deleted here. Since the word-initial vowel is actually a morpheme that marks inalienable possession, it is automatically substituted by a different possessive morpheme according to the context. Thus in (69) a. above,

(70) /ba/ + /ɯgʒɯ/ → /ba/ + Ø-gʒɯ/ 'hand' → /bagʒɯ/

The same process holds for kinship terminology too, further confirming the hypothesis that the first vowel in kinship terminology, when present, is a remnant of inalienable possession marker.

(71) Initial morpheme deletion in kinship terminology

a. /ba/ 'your' + /aje/ 'brother' → /baje/ 'your brother'

b.

4.2.4 Coronal CV sequence constraints

The Hrusso Aka consonant-vowel distribution is shown in the following table. The table shows the distributional constraints that at the segmental level, before core syllabification has applied[32]. From the table it is clear that most CV sequences are allowed. Among the CV sequences that are not found in the data, some may be accidental, like */ʒo/ or */te/.

Table 4.12: Distribution of Vowels and Consonants

	p_	b_	f_	v_	m_	t_	d_	s_	n_	l_	t͡ʃ_	d͡ʒ_	ʃ_	ʒ_	ɲ_	ʎ_	ʂ_	ʐ_	k_	g_	χ_	ʁ_	ŋ_	w_	j_
ɯ	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+	+	-	+	+	-	-
u	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+
e	+	+	-	+	+	-	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+
a	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+
o	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	-	-	+	+	+	+	-	-	+
i	+	+	+	+	+	-	-	-	-	-	+	+	+	-	+	+	-	-	+	+	+	+	-	-	+
ɤ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-

However, the following constraints are well-attested:

(72) CV sequential constraints:

a. No coronal high vowel after a dental or a retroflex consonant. (eg. */ti/, */ni/ */ʂi/, */ʐi/)

[32] Core syllabification is discussed in sec. 5.2.2. The C-V sequence is the most significant at the segmental level, since core syllabification prevents any other segmental sequence within a syllable. Other sequences like V-V or V-C sequences apply after the core syllabification and involve syllable constraint rules.

This constraint does not apply to the alveopalatal consonants. A featural analysis of the segments involved reveals the reason for these constraints.

Table 4.13: Feature comparison of the coronal vowels and consonants

a.

	TONGUE HEIGHT		TONGUE ROOT	
	[HIGH]	[LOW]	[ATR]	[RTR]
/i/	✓		✓	
dental				

b.

	TONGUE HEIGHT		TONGUE ROOT	
	[HIGH]	[LOW]	[ATR]	[RTR]
/i/	✓		✓	
retroflex	✓			✓

c.

	TONGUE HEIGHT		TONGUE ROOT	
	[HIGH]	[LOW]	[ATR]	[RTR]
/i/	✓		✓	
alveopalatal	✓		✓	

From the above tables, it is clear that the $C_{[COR]}V_{[COR\ HIGH]}$ sequences are allowed iff the TONGUE HEIGHT and TONGUE ROOT features are exactly the same for C and V. The following phonological rule governs this process:

(73) A $C_{[COR]}V_{[COR\ HIGH]}$ sequence is not allowed unless both the segments have the same PLACE features.

4.3 High Vowel devoicing

High devoicing is attested in many languages; some languages devoice all vowels in certain environments and others only some, especially the high vowels.[33] Japanese is considered to be a prototypical example of high vowel devoicing (henceforth HVDv) and the phenomenon has been extensively studied (Kondo 1997; Tsuchida 1997; Varden 1998; Teshigawara 2002; Ogasawara 2013). A brief survey of Japanese high vowel devoicing and the debate surrounding it is useful for the study of Hrusso Aka High vowel devoicing. Teshigawara (2002) observes the following pertinent facts regarding Japanese high vowel devoicing:

a. High vowels are devoiced between two voiceless consonants.

(74) /sika/ 'deer' [ʃi̥ka]

(75) /hukahuka/ 'soft' [ɸu̥kaɸu̥ka]

b. High vowels are devoiced word finally when preceded by a voiceless consonant.

(76) /kasi/ 'lyrics' [kaʃi̥]

c. Accented vowels are not devoiced, whatever their environment. However, there are exceptions to this rule as stated below.

[33] For example, Jaeger (1978 p. 314) points out that of the 221 languages in Stanford Phonology Archive, 44 had voiceless vowels, and of these, 20 only or preferentially devoiced high vowels.

d. In some cases, there is a free variation between voiceless and voiced vowels even when the environmental conditions listed above are present.

(77) /ˈsihai/ ‘vaporization’ [ˈʃihai] or [ˈʃi̥hai]

Analysis of the Japanese HVDv vary. Citing previous literature and experimental proof, Tsuchida (1997) considers the Japanese voiceless vowels as specified for [spread glottis] feature. HVDv, according to him, is the surfacing of this feature when a high vowel is surrounded by voiceless consonants. Varden (1998), considers HVDv as spreading of the feature [spread glottis] from the surrounding consonants rather than the surfacing of a vowel-specified feature. Teshigawara (2002), analyses the Japanese HVDv using [-voice] feature, arguing that aerodynamically motivated constraints using the [-voice] feature yields a better way of predicting devoicing outcomes in all environments.

There is also some dispute as to whether devoicing should be called that at all. Hasegawa (1999) calls the term vowel devoicing as oxymoronic and says that the so called devoiced vowels in Japanese are deleted. The deleted vowels are mistakenly seen as devoiced. As for the non-devoicing of vowels in slow speech, which is cited as a proof for the underlying presence of the devoiced vowels, Hasegawa says that this is, at least partly, due to the syllabic orthography of the language, which influences the speakers’ perception that the dropped vowels are somehow present but hidden. However, Hasegawa’s position does not explain certain facts in vowel devoicing languages like Oneida, Blackfoot (Gick et al. 2012) and Hrusso Aka, where even though vowels may be completely hidden due to devoicing, their articulatory gestures are preserved. Nor does it explain the fact even illiterate Hrusso Aka speakers do not devoice vowels in slow speech, thus disproving that orthography influences speakers’ perception in mistakenly considering the deleted vowels as present.

Therefore, I consider HVDv as a distinct phenomenon from vowel deletion. In Hrusso Aka, as I shall discuss below, both HVDv and high vowel deletion (henceforth HVDel) are present, and must be carefully distinguished in order to understand the syllable structure.

There is dispute in the literature about the consistency of HVDv in Japanese. For example, Teshigawara (2002) points out that sometimes non-high vowel, vowels preceding a voiced consonant and accent-bearing vowels undergo devoicing. Citing Sagisaka and Yoshida (1990) he notes that about 4% of the devoiced vowels belong to such non-typical category. There are also other problems like cross-speaker inconsistency, and sampling inconsistency.[34] Hrusso Aka is no exception to such inconsistencies. I have noticed that at times the low vowel /a/ is devoiced, at other times, unstressed devoiceable vowels are voiced even in the devoicing environment. Teshigawara (2002) chooses to bypass these exceptional cases and focuses only on the typical cases, since there is no satisfactory explanation to this phenomenon. I shall argue, however, that in Hrusso Aka, the atypical cases give an important insight into the nature of HVDv, and must be included in the study.

4.3.1 HVDv in Hrusso Aka

Hrusso Aka devoices the high vowels /i/, /u/ and /ɯ/ according to the following rule:

(78) HVDv rule:

Devoice a high vowel following a voiceless consonant provided the vowel is not the nucleus of a stress-bearing syllable.

(79) Examples for HVDv rule

[34] For example, a speaker, while being recorded, may unconsciously make his speech slow and deliberate, thus reducing the occurrence of devoiced vowels.

a. /huːtʂɯ/ ‘tiger’ [xu̥ːtʂɯ]

b. /huːsad͡ʒʲo/ ‘water hen’ [xu̥sad͡ʒʲo]

c. /kɯːsɯʷ/ ‘seer’ [ku̥ːsɯʷ]

d. /piːsɯʷ/ ‘grind’ [pi̥ːsɯʷ]

e. /aki/ ‘uncle’ [akʰi̥]

f. /apu/ ‘milk’ [apᶲu̥]

4.3.2 Data

Following are the spectrograms and wave form depictions of words that show HVDv in Hrusso Aka.

Figure 9: Voiced high vowel in the word /xu/ ‘water’ [xu]

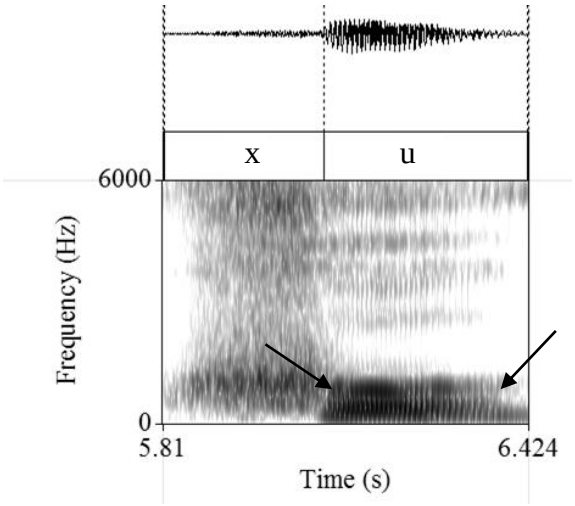
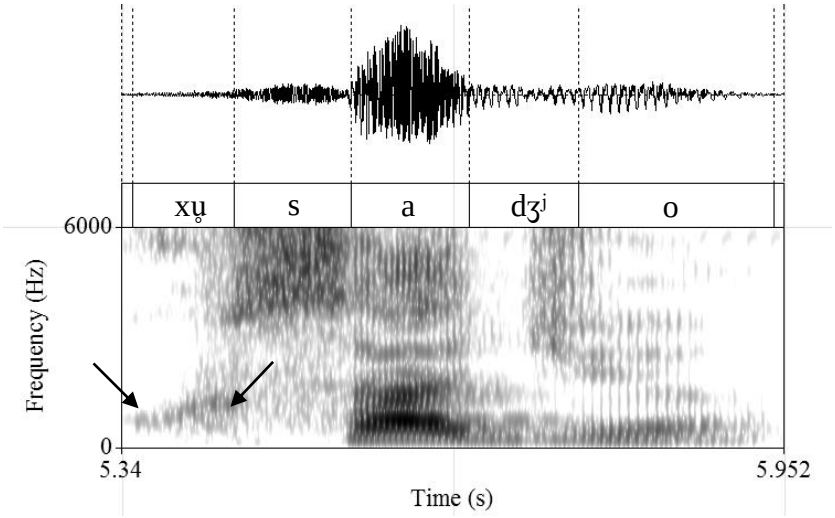


Figure 9 depicts the pronunciation of /hu/ ‘water’ where /u/ is voiced. Since /u/ is the nucleus of a stressed syllable[35], the vowel cannot be devoiced.

[35] In Hrusso Aka the high tone H is the marker of stress. See sec. 5.3.

Figure 10: devoiced vowel in /χusadʒʲo/ 'water hen' [xusadʒʲo]



On the other hand, in Figure 10, which depicts the pronunciation of /husadʒʲo/ 'water hen/, the stress is on the second syllable, and the high vowel /u/ is devoiced. The vowel /u/ and the consonant /h/ are almost completely merged and it is difficult to tell them apart. Can this be considered vowel deletion as Hasegawa (1999) has argued? What is seen in Hrusso Aka is not vowel deletion but tautosyllabic consonant-vowel overlapping due to which the vowel is reduced and obscured (Cf. Coleman 1992, 2001). The evidence for this comes from two observations. First, in slow speech which reduces overlapping, [xu̥sadʒʲo] is rendered as [xu-sa-dʒʲo], that is, with full voicing of /u/ which is pronounced distinctly from the preceding consonant. The second piece of evidence is that in connected speech the articulatory gesture of lip rounding is preserved even when the vowel is not discernible. Gick et al. (2012) point out a similar phenomenon in Blackfoot and Oneida languages, where vowels are completely obscured, or become 'soundless' but their articulatory gestures are preserved.

I shall show here one clear example of this phenomenon in Hrusso Aka. In the examples (79)a. [xu̥ɪˈtʂɯ] 'tiger' and (79)b. [xu̥sad͡ʒʲo] 'water hen', the only difference

between the two devoiced vowels is lip rounding in the latter word, and if the vowels are present after devoicing, then lip rounding should also be present in pronunciation, although only /h/ is heard. The figures below, taken from the video recordings of the devoiced vowels, illustrate that the lip gestures are present.[36] The pictures show both the front and the side view simultaneously[37]. The picture on the left shows spread lips during the pronunciation of [ɯ̥] and the picture on the right shows rounded lips during the pronunciation of [u̥]. This clearly proves that the vowels are not deleted but devoiced and/or reduced.

Figure 11: Lip gestures in the pronunciation of [ɯ̥] and [u̥]

[ɯ̥]

[u̥]

4.3.3 Feature Analysis of HVDv

Analyses based on [-VOICE] such as Teshigawara's (2002) are not sustainable in FUL model since the model rejects the negative features. The spreading of [SG] feature from a voiceless consonant to the following high vowel is a better explanation. I contend that the redundancy relationship found in many languages, where [VOCALIC] => [VOICE] does not exist in Hrusso Aka vowels that is, the vowels are not specified for voicing. Their voicing

[36] These figures are from the video files recorded on 20/08/2014 and 19/082014 respectively. They have been printed here with explicit consent of Mr. DS.

[37] The side view was captured using a mirror.

comes from phonetic and sonority related factors rather than a laryngeal specification. As Jaeger (1978) points out, the high vowels are aerodynamically more easily prone to devoicing as compared to the low vowels. Low vowels naturally resistant to devoicing since they are higher on the sonority scale. Therefore, in the absence of the laryngeal feature in vowels, the natural phonetic processes take over and voicing is determined by aerodynamic processes and the environment.

The consonants on the other hand, are in [VOICE] vs [SPREAD GLOTTIS] opposition, that is, voiced consonants are specified for the former feature and the voiceless consonants, the latter. These three facts, stated in the hypothesis below, explain most of the phonotactic interaction between vowels and consonants in CV environments.

(80) **Hypothesis**: In Hrusso Aka,

a. Vowels are unspecified for the laryngeal features.

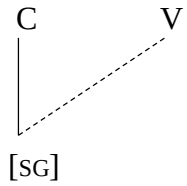
b. Voiced and Voiceless consonants are specified for [VOICE] and [SG] respectively.

Based on this, HVDv can be explained as a two-step process as follows:

4.3.4 An analysis of HVDv

Step 1: [SG] feature spreading: In agreement with Varden's (1998) analysis of Japanese, HVDv can be viewed in terms of the spreading of [SG] feature from a voiceless consonant. However, in a departure from Varden's position, I propose that the spreading of the [SG] feature occurs to all the vowels, not just the high vowels.

(81) [SG] feature spreading to a vowels in Hrusso Aka



Step 2: Output based on phonetic factors: Note that in the above step all the vowels have acquired the [SG] feature. This feature now interacts with the sonority and aerodynamic factors, in order to give each vowel its surface output. This analysis predicts the following.

a. [SG] should be more noticeable in high vowels since they are low on the sonority scale.
b. [SG] should be hidden in non-high and stressed vowels since aerodynamics and sonority trump the acquired [SG] feature.
c. Since at each output the [SG] and the phonetic factors are simultaneously present, there should be a some level of inconsistency in the data, where one factor randomly wins over the other.

This is exactly what is found in the data. While as per HVDv rules a majority of the high vowels are devoiced and a majority of the non-high and the stressed vowels are voiced in the environments explained above, there in a small portion of the data, voicing and devoicing are completely random, confirming the hypothesis.

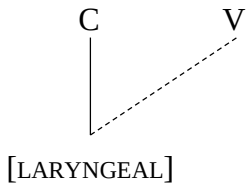
This hypothesis can be extended to all consonant-vowel interactions in Hrusso Aka as follows:

(82) Hypothesis on laryngeal feature spreading in Hrusso Aka

a. Vowels are unspecified for laryngeal features.

b. Voiced and voiceless consonants are specified for [VOICE] and [SG] features respectively.

c. A vowel takes on the laryngeal features of the preceding consonant.

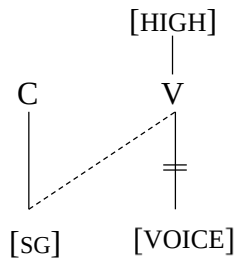


In the case of voiced consonants therefore, it is the [VOICE] that spreads to the following vowel, and therefore, one never finds a devoiced vowel following a voiced consonant. This simple rule explains all the consonant-vowel interactions in CV environment.

4.3.5 [VOICE] delinking?

Another possible hypothesis based on [SG] feature spreading, though it will be inadequate for the analysis of the Hrusso Aka data, is that the vowels are specified for the [VOICE] feature, and this feature is delinked when the [SG] feature spreads to the vowel. This can be formalized as follows:

(83) [SG] feature spreading and [VOICE] feature delinking.



However, this fails to explain some of the facts in the data. First of all, as in Japanese, there are cases of partial devoicing in Hrusso Aka. This may happen randomly or in the C̥VC environment. If [VOICE] feature is delinked, how does it partially come back? Secondly, the above representation does not explain the free variation and inconsistency in vowel devoicing. Why is it that at times even stressed vowels and non-high vowels get devoiced? And thirdly, why do stress-bearing syllables retain voicing? In other words, why does delinking of [VOICE] and the spreading of the feature [SG] fail to occur in some cases? The hypothesis (82) which says that the vowels are unspecified for [VOICE] answers these questions adequately.

4.3.6 A corollary: Voiceless plosive allophony

Voiceless plosive allophony described above in section 2.2.1 is an effect of the [SG] feature spreading to high vowels. It may recalled that, preceding the high vowels the voiceless plosives are affricated as listed in (16). Affrication of voiceless plosives before the high vowels is also a cross-linguistically attested fact and is seen as a strategy of increasing perceptual salience(Cf. Lin 2011). In the light of this observation the Hrusso Aka plosive affrication can be understood as follows:

a. According to HVDv Rule, Hrusso Aka devoices vowels in C̥V environment.
b. Since the syllable nucleus is devoiced, this creates the problem of perceptual obscurity.
c. As a solution, perceptual salience is increased by accentuating [SG] feature, by delaying the release of the stop, which leads to building up of the air pressure behind the point of closure, and consequently, affrication when the air is released.

d. Affrication occurs only for /p/ and /k/ and not for /t/. This is because affrication of /t/ is blocked due to a lexical clash. If /t/ were to be affricated, it would become /ts/, which already exists as a consonant cluster (see Chapter 6) therefore, only aspiration of /t/ takes place, not affrication.

Some examples for the voiceless plosive affrication are,

(84) Affrication of voiceless plosives /p/ and /k/, and aspiration of /t/

a. /apu/ [apᶲu̥] ‘milk’

b. /kiw/ [kˣi̥w] ‘send’

c. /tukʃuw/ [tʰu̥kʃuw] ‘steal a drink’

4.4 Conclusion

The morpho-phonological processes analysed in this chapter raise some interesting questions. For example, why is that vowel harmony is found only in body part terminology? What is the basis for the fact that only /a/ allowed root initially and not others? Since no VV sequences occur anywhere else in the language, can the doubtful sequence /-ɤw/ be definitively considered a vowel-consonant sequence?

The chapter has also provided some answers to orthographic puzzles, especially through the HVDv rule. I shall highlight these in the conclusion to this thesis.

Chapter 5. The Hrusso Aka Syllable

5.0 Introduction

This chapter has four parts. In the first part I discuss the basic conceptual framework of the syllable I use in this study. In the second part I survey the core syllabification in Hrusso Aka. The third part is a brief study of Hrusso Aka stress with a view to understanding the surface syllabification. In the fourth part I discuss the Hrusso Aka surface level syllabification or 'resyllabification', and the rules governing this process. Finally in the conclusion, I suggest some avenues for further research in light of the questions raised in this study.

5.1 The syllable: Definition and Concepts

5.1.1 Defining the Syllable

Notwithstanding that the syllable is an ancient concept that has been explored by the Greek and Sanskrit grammarians (Awedyk 1975 p. 7) the debate about it in the current literature is still raging. The debate is centred on the exact nature of the syllable, its definition and representation. An important question that has been quite settled in the current phonological theory however, is the necessity of the syllable. Soon after *SPE* denied a place for the syllable and Kohler (1966) argued that the syllable is not a language universal, a number of generative phonologists started rediscovering its importance (J. M. Anderson 1969; Fudge 1969; Hooper 1972; Vennemann 1972; Shibatani 1973; Kahn 1976), and it is now generally accepted that the syllable is an integral part of the prosodic hierarchy of a language (Selkirk 1982; Blevins 1995; Nespor & Vogel 2007; Duanmu 2009 among others; Hulst & Ritter 1999 summarize recent

developments in the syllable theory). Of the various arguments that have been put forth in support of the syllable Selkirk (1982 p. 328) lists the three most important ones:

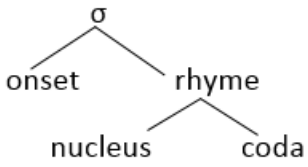
a. The syllable is the reference point for the most general and explanatory statement of phonotactic constraints in a language.
b. Domains of application in case of a wide range of rules of segmental phonology can be characterised only through the syllable
c. Suprasegmental phenomena such as stress and tone requires a syllable-based grouping of segments. Segments be grouped into units which are the size of the syllable.

As for the exact nature of the syllable, definitions based on phonetic and physiological correlates as in Pike & Pike's (1947) view of the syllable as 'peaks in strictural degree' or Stetson's (1951) well known 'chest pulse' theory or Awedyk's (1975 p. 49) definition of the syllable in terms of opening of the vocal tract have proved problematic since none of these definitions have been successfully able to explain varied cross-linguistic data (Ladefoged, Peter & Ian Maddieson 1996 p. 282). A generally accepted current theory of the syllable, though not without controversy, is that it is phonetically a 'sonority peak,' and phonologically, the smallest unit in the prosodic hierarchy (E. O. Selkirk 1982; Blevins 1995; Ewen & Hulst 2001; Nespor & Vogel 2007). According to Blevins (1995 p. 207) Syllables, being sonority peaks, act as the "structural units providing melodic organization to a phonological string in a language, just as the feet act as the units of rhythmic organization." I shall adopt this view of the syllable in this study.

5.1.2 Internal Structure of the Syllable

Among the various models of the internal structure of the syllable, the 'flat structure' model (Kahn 1976; Clements & Keyser 1983) does not posit an internal hierarchy within the syllable constituents. Moraic approaches, too, instead of looking into the syllable internal structure, focus on syllable weight and its role in the prosodic structure of a language (Hayes 1989; L. Hyman 1985; McCarthy & Prince 1986). Among the hierarchical models the most important one is the Onset-Rhyme (OR) model (Pike & Pike 1947; Kuryłowicz 1948; Pike 1967; Fudge 1969; Halle & Vergnaud 1980; Harris 1983; E. O. Selkirk 1982; Fudge 1987) where the syllable is thought to be divided into onset and rhyme, and the rhyme further subdivided into nucleus and coda.

(85) OR model



I shall use the OR model in this study, since it is best explains the Hrusso Aka syllable structure as will be clear in the discussion below.

5.1.3 Domains and Levels of Syllabification

Before I begin the study of the Hrusso Aka syllable, a clarification of two crucial notions is in order: first, the domain of syllabification, second, the levels of derivation at which syllabification occurs. According to Nespor and Vogel (2007 p. 62) the syllabification domain is that morphosyntactic unit of a language's grammar within which segments are grouped together into well-formed syllables. For example, in English the syllabification domain is the stem and any non-neutral affix adjacent to it (p.64) and

in German, the morpheme (Laeufer 1985). As for the levels of syllabification, Nespor and Vogel (p.68-69) recognize two of them. At the first level, which they term the 'syllabification' level, it is the universal syllabification rules such as the Maximal Onset Principle that guide the process of syllable formation. At this level the domain is typically small.[38] The second level is language-specific and typically has larger domains that must be further specified. Nespor and Vogel call this 'resyllabification'. For Hrusso Aka the domain of resyllabification is the phonological word.

5.1.4 Syllabification Procedure

I shall follow the syllabification procedure as in Coleman (2001 p. 31), based on Kahn (1976):

(86) Syllabification steps

a. Nucleus projection: First of all, classify vowels (including long vowels and diphthongs if allowed in the language) as the syllable nuclei.

b. Application of Maximal Onset Principle (MOP)[39]: This involves assigning as many consonants as legitimately possible to the onset position in the syllable.

c. Coda adjunction: Assign any remaining consonant to the coda position.

When there are consonant sequences on any one side of the nucleus, the decision on whether such sequences should go into the onset slot or should be broken across

[38] For Nespor and Vogel the domain of 'syllabification' is the phonological word (p. 68)

[39] MOP, proposed by Kahn (1976) states "First make the onset as long as it legitimately can be; then form a legitimate coda."

syllable boundaries as coda and onset can be made based on the sonority sequencing principle.

Sonority Sequencing Principle (SSP): Based on the observations of Sievers (1881) and Jespersen (1904) regarding the sonority organization within the syllable, SSP is stated as,

(87) Between any member of a syllable and the syllable peak, only sounds of higher sonority rank are permitted. (Clements 1990 p. 285)

5.1.5 Sonority Scale and Consonantal Strength

SSP is based on the sonority hierarchy of phonological segments, which is a crucial factor in syllabification. Following the general agreement among researchers, Clements' (1990) adapts the following sonority hierarchy on a 0 to 4 scale:

(88) Clements' sonority hierarchy

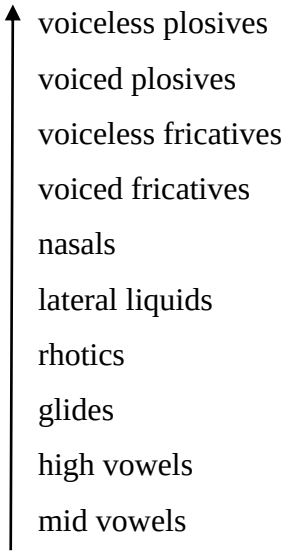
O <	N <	L <	G <	V
0	1	2	3	4

Where obstruents are represented as O, nasals as N, liquids as L, glides as G and vowels as V.

The consonantal strength scale, the opposite of sonority hierarchy, arranges segments in the increasing order of consonantality and decreasing order of sonority. I shall use Vennemann (2012 p. 13) to rank segments according to their consonant strength hierarchy. As Vennemann notes, his ranking is not without controversy. Some linguists opt for finer distinctions than proposed in the above scale and others for broader ones.

However, the cluster summary in Table 5.15 is based on Vennemann's hierarchy, and it adequately represents the sonority hierarchy in Hrusso Aka.

(89) Consonantal strength scale (Vennemann 1988 p. 9)



5.2 Syllabification in Hrusso Aka

Based on the above discussion, the syllabification procedure can be applied to Hrusso Aka as in the following example:

(90) Syllabification of /nodzam/ 'my friend.F'

a. Projection of syllable nuclei: the vowels /o/ and /a/ are the syllable nuclei.

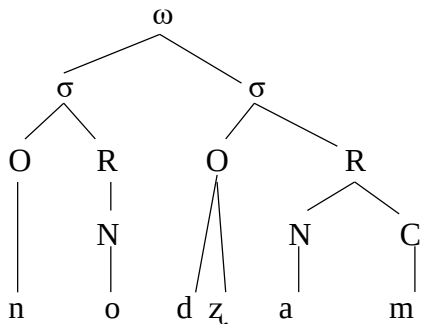
b. MOP application: /n/ is certainly an onset. The sequence /dz/ occurs word-initially, and also satisfies SSP.[40] Therefore, it should be assigned to onset as well.

[40] Satisfying SSP is not a definitive test for syllabification, but can only be used as a pointer. This is because in many languages SSP is violated during syllabification.

c. Coda Adjunction: The only leftover consonant is /m/. This is attached to the preceding nucleus as its coda.

Thus there are two syllables in the word. Indicating the syllable boundary with a full stop, the syllabified word can be written as /no.dz̨am./.

(91) Syllable structure of /nodz̨am/



5.2.1 Domains and Levels in Hrusso Aka Syllabification

Based on the available data, I posit two levels of syllabification in Hrusso Aka. One at the underlying or the lexical level, and the other, at the surface level, as used in normal connected speech. At the underlying level the syllabification domain is the underived lexical root. I shall call syllabification at the underlying level core syllabification after Clements (1990). At the surface level of syllabification, the domain is the phonological word. Syllabification at this level is subject to new sequencing constraints introduced by stress, phonotactics and other such phenomena, and gives rise to syllable types that are not found at the underlying level.

5.2.2 Core Syllabification in Hrusso Aka

In Hrusso Aka only (C)CV and V syllables are allowed at the core level. CCV syllables are quite common but the branched onsets in such syllables can be only

Obstruent-Sibilant sequences. These onset clusters have a special status in the language and will be discussed at length in the next chapter.

As already stated, underived lexical roots which are either free or bound morphemes are the domains of core syllabification. The following lists exemplify core syllables:

(92) Bound roots with CV/CCV structure

a. /la-/ ‘bring’

b. /ʃo-/ ‘smell’ (verb)

c. /tu-/ ‘say’

d. /dʐɯ-/ ‘sell’

(93) Free morphemes with V syllable structure

a. /a/ ‘one’

b. /i/ 3SG

c. /u/ ‘good’

d. /o/ ‘paddy’

e. /e/ ‘yes’ (rarely used)

(94) Free morphemes with CV/CCV structure

a. /ha/ ‘what’

b. /bo/ ‘money’

c. /dʐu/ ‘sun’

d. /kʂɯ/ ‘rubber’

Lexical roots are overwhelmingly monosyllabic, and the maximum root length is two syllables, having either V.CV or CV.CV structure. [41]

(95) Disyllabic free morphemes with core syllabification

a. /a.va/ V.CV ‘rice’

b. /a.ʂa/ V.CV ‘cat’

c. /fɯ.ta/ CV.CV ‘fence’

d. /nu.ku/ CV.CV ‘darkness’

There is one exception to the rule that only CV and V syllables are allowed at the underlying level, that is the word /am/ ‘yes’. I shall disregard this exception in this study. Another seeming exception is /kɯʎ/ ‘night’, but there is evidence that this is /kɯʎi/ at the underlying level, since this alternative form is used quite frequently, especially in formal language. The form /kɯʎ/ can be derived through surface syllable rules as I shall show below in section 5.4.1.2.

Surface level syllabification, or resyllabification, occurs in Hrusso Aka when the roots and other morphemes concatenate at the word formation level. Before I discuss the surface syllabification it is necessary to understand the basic stress rules in the language, since these play a role in the surface syllabification. The following is an excursus on stress.

[41] In the corpus I found no polysyllabic roots. Disyllabic roots of the CV.CV type are also rare, but V.CV type where the initial V=/a/ are relatively more common since /a/ can occur root-initially. Most words are formed by agglutination of monosyllabic roots that are easily isolable. For example, /fumi/ ‘deer’ is /fu/ ‘meat’ + /mi/ ‘fire’ or ‘fiery meat’ perhaps because of the animal’s reddish colour. Night is /ɲegi/ which comes from /ɲe/ ‘house’ + /gi/ ‘black’ alluding to the nightly darkness.

5.3 Stress

This section provides only a brief introduction to stress in Hrusso Aka, mainly with a view to understanding the surface syllable structure. Hrusso Aka is a pitch accent language that has High-Low pitch distinction. This tone distinction assigns prominence to its syllables. Bybee et. al. (1998 p. 227) define a pitch accent system as "one in which pitch is the primary correlate of prominence and there are significant constraints on the pitch patterns for words". As will be seen below, this is true of Hrusso Aka. Hyman (2006 p. 237) further notes that by a pitch accent system phonologists mean one of the following:

(96) Properties of pitch accent systems

a. A system that has surface realizations that are abstractly different from their underlying prosody.

b. A system that combines tone and stress.

c. A system where tone is restricted, rare or privative.

Hrusso Aka is a pitch accent system that has the last two properties.

Stress in pitch accent languages has been analysed both from tonal and metrical point of view – for example, Lithuanian is analysed by Halle and Vergnaud (1987) from a metrical point of view, but as a tonal system by Blevins (1993). Hayes (1995 p. 365) recommends a mixed approach, while at the same time recognizing that it is possible to approach pitch accent systems purely from tonal point of view. I shall take a mixed approach in analysing Hrusso Aka stress, by approaching stress as a phenomenon based tone that has metrical consequence at the surface level.

Hrusso Aka stress is not sensitive to syllable quantity. Hayes (1995 pp. 270–71), makes a distinction between languages that are sensitive to syllable quantity on one hand and syllable prominence on the other. Prominence, or "perceptual salience", may be defined crosslinguistically in terms of tone, vowel quality and so on, but in Hrusso Aka it is the tone that is the basis of perceptual salience.

5.3.1 Tone or 'Pitch Accent'

At the lexical level Hrusso Aka has two tones namely, high (H) and low (L). The lexical contrast between them is illustrated in the examples below:

(97)

a. H — σ — /dzɯ-/ 'ask'

b. L — σ — /dzɯ-/ 'die'

(98)

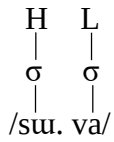
a. H L — σ σ — /sɯ. na/ 'a spice'

b. L H — σ σ — /sɯ. na/ 'likewise'

Following are some examples involving different syllable types. Keeping the tone sequence the same, ie., HL, various syllable types are shown in order to demonstrate that syllable type does not influence syllable prominence.[42] This is important in order to demonstrate that it is the tone and not the syllable type or quantity that determines Hrusso Aka stress.

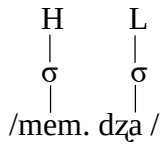
[42] That is, to show that H tone is not a prosodic prominence based on syllable weight.

(99) CV. CV word



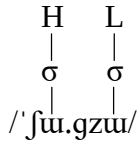
‘a type of bamboo’

(100) CVC. CCV word



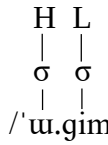
‘soon’

(101) CV. CCV word



‘eight’

(102) V.CVC word



‘tail’

Appendix 1 contains a sample of stress analysis with the help of a story narration transcription. Some words from Appendix 1 are shown below. The numbers in brackets to the extreme right indicate the serial word numbers in the text in Appendix 1, which will help in easily identifying the words in the appendix. The analysis and conventions are based on Hayes (1995 pp. 275–78). In marking the stress, the following procedure was applied to the continuous speech analysed in Appendix 1:

(103) Stress marking steps in Hrusso Aka:

a. **Domain of Analysis**: Identify and demarcate phonological words, which are the domains of stress. (In the appendix these are demarcates by vertical box lines.)

   eg. /lɯha/ 'morning'

b. **Syllabification**: Divide syllables according to the procedure discussed above.

   /lɯ. ha./

c. **Tone marking**: Identify tones and mark on each syllable.

   H L
   /lɯ. ha./

d. **Grid construction:**[43] Mark syllables with H tone, with ** and those with L tone with * as shown below. This is the prominence grid.

   *
   * *
   H L
   lɯ. ha

e. **Main stress marking**: On the metrical line in the grid, that is, the highest tier, mark the strongest syllable in the word with an 'x' mark.

[43] The grid formalism is based on Hayes (1995 p. 279), which he uses for analysing stress based on tone. The '*' marked layers constitute the prominence grid, and the topmost layer is the metrical grid.

x
*
* *
H L
lɯ. ha

f. Repeat this procedure for all the words in the text.

g. **Result**: It is seen at this stage that the stress-bearing syllables will always have H tone, and the right-most syllable with the H tone gets the main stress in the word. That is, Hrusso Aka has End Rule Right metrical system.

The examples below illustrate Hrusso Aka stress system.

(104) x (1)

* *
* * * * *
H L L H L
fu. ba. ʌe. ˈt͡ʃɯ. ssɯ̥.

(105) x (2)

* *
* * * * *
H L L H L
ba. dzɯ. ʌe. ˈdo. ʁi.

(106) x (3)

*
* *
H L
ˈ t͡ʃi. t͡ʃʲo.

(107) x (8)

* *
* * * * *
H L H L L
ʂɯ. mzo. ˈdzɯ. tʂɯ. me.

(108) x (66)

* *
* * * *
L H L H
ma. tsa. kʲe. ˈsːɯ.

Based on the above analysis, the following stress rules can be assigned to Hrusso Aka:

(109) Hrusso Aka stress rules:

a. **Basis of stress:** Tone

b. **Prominence projection**: In the prominence grid, assign the following hierarchy to syllables:

H tone **

L tone *

c. **Metrical Structure**: End Rule Right

5.3.2 Stress in word formation.

Three stress-related behaviours in word formation are illustrated below, namely clash resolution, floating tone and stress reassignment.

5.3.2.1 Clash Resolution

When morphemes are concatenated, the original H and L tones are retained. The main stress will be assigned with End Rule Right, and other H syllables get a secondary prominence in the word. However, no HH sequence is allowed in the resulting word. Any violation of this is resolved by demoting the H tone on the left side of a HH sequence to L.

(110) H-H clash resolution

Word /trudou/ '(that which is) said'

morphemes /tʂu-/ 'say' /-dou/ ADJ.PART

Syllables and tones

```
x       x
*       *
*       *
H       H
|       |
tʂu.  +  dou.
```

Stress clash

```
x   x
*   *
*   *
H   H
|   |
tʂu. dou.
```

Clash resolution

```
L   H
|   |
tʂu. dou.
```

Stress reassignment

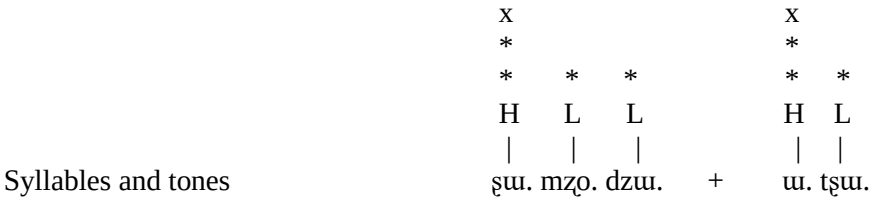
```
    x
    *
*   *
L   H
|   |
tʂu. dou.
```

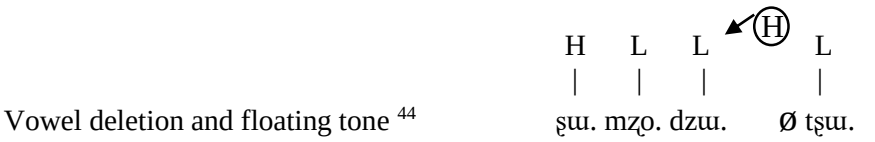
5.3.2.2 Floating tone, and stress reassignment

When tone-bearing segments are deleted due to phonotactic constraints, the tone is retained and reassigned as illustrated below. The example also illustrates the reassignment of stress after new word formation.

(111) Word: / ʂɯmzǫˈdzɯtʂɯ/ ‘orchid story’

Morphemes ˈʂɯmzǫodzɯ + ˈɯtʂɯ ‘orchid’ + ‘ story’





Output /ʂɯmzǫˈdzɯtʂɯ/

[44] It is the initial vowel /ɯ/ of the second morpheme that is deleted as per the rule explained in sec 4.2.3.

[45] There are two ways of looking at this phenomenon. First, since Hrusso Aka does not allow contour tones, the stronger H tone replaces the weaker L tone. The second and more plausible explanation is, as mentioned in footnote **Error! Bookmark not defined.**, this might indicate that tone is privative in H russo Aka, and L might be an empty slot where the floating H lodges itself. More research is needed to definitively prove that one or the other is the case.

A full account of the stress and tonal system of Hrusso Aka is yet to be worked out. However, the preliminary discussion in this section is sufficient to understand some of the resyllabification processes which I shall discuss in the following section.

5.4 Resyllabification

Resyllabification occurs when morphemes concatenate to form derived words. At this level, in addition to the (C)CV and V syllable types from core syllabification, two more syllable types are added, (C)CVC and VC, making the Hrusso Aka maximal syllable template (C)(C)V(C).

A comparison between the two levels of syllabification is given below:

Table 5.14: The two levels of syllabification

Level	**Domain**	**Syllable types**	**Coda**
I: Root	lexical root	CV, CCV, #V	No Coda
II: Word (affixation, compound words, stress interaction)	phonological word	CV, CCV, #V, CVC, CCVC, #VC	/m/, /ʎ/, /ɲ/ are allowed in word-medial and word-final coda; Other consonants (see Table 5.15) are allowed only in word medial coda.

5.4.1 Surface-level syllable rules

5.4.1.1 Coda formation

While codas are prohibited at the core syllabification level they are allowed at the surface level as a result of the three rules listed below. The first two lead to only word medial codas whereas the third forms word-final codas as well.

5.4.1.2 High Vowel Deletion -1 (HVDel -1)

(112) HVDel-1 Rule: A word medial high vowel /ɯ/ is deleted in a non-stressed syllable, provided that the preceding vowel is open. The onset of the syllable that loses its vowel is incorporated as the coda of the preceding syllable.

(113)

/ɯ/ → ø / [...V [C___]σ ...]ω
                |
                L

This rule is illustrated in the following derivaton:

(114) Eg. /dagˈdʐ̺aha/ clean (imperative)

Derivation:

Input /da/ 'do' + /gɯdʐ̺aha/ 'clean' (imperative)

↓

Morpheme concatenation

da. gɯ. ˈdʐ̺a. ha
      |
      L

↓

/ɯ/ deletion

da. gØ. ˈdʐ̺a. ha

↓

Resyllabification

dag. ˈdʐ̺a. ha

↓

Output

/dag. ˈdʐ̺a. ha/

(115) Some other examples for HVDel-1

a. /ɯ/ ‘body part prefix’ + /l**ɯɯ**du/ ‘musculature’→ /ˈɯl.du/ ‘muscle’

b. /na/ ‘3PL’ + /mɯko/ ‘midst’ → /ˈnam.ko/ ‘their midst’

5.4.1.3 HVdel-2 and Coda formation with /m/, /ʎ/ and /ɲ/

The segments /m/, /ʎ/ and /ɲ/ are allowed both syllable and word finally during resyllabification. High vowels that occur root-finally in the lexicon after /ʎ/ and /ɲ/ are dropped at the surface level. This allows /ʎ/ and /ɲ/ in the coda.

(116) Dropping of word-final high vowel

a. /aɲi/ → /aɲ/ ‘mother’

b. /lɯha-kɯʎi/ → /lɯhakɯʎ/ ‘nowadays’

The morpheme /-m/, the feminine gender marker is also allowed in the coda.

(117) The morpheme /-m/ in the coda

a. /sa/ ‘child’ + /-m/ F → /sam/ ‘daughter’

All the three morphemes also occur word medially in the coda position.

(118) Word medial /m/, /ʎ/ and /ɲ/ codas

a. /mim.sa/ ‘girl’

b. /aɲ. dʐa/ ‘with mother’

c. /kaʎ.d͡ʒo/ ‘will go’

5.4.1.4 Post-stress gemination

(119) **Post-stress gemination rule**: Onsets of a word medial syllable whose nucleus is a high vowel undergo gemination following a stressed open syllable.

$$C \rightarrow C\text{ː} \,/\, [\ldots CV.\ \underset{\underset{[\text{HIGH}]}{|}}{\overset{x}{\_\_\_}}\ V\ldots]_{\omega}$$

(120) Examples for post-stress gemination

a. [ˈpaddɯʁa] ‘a mythical deer’

[pa. dɯ. ʁa] → [ˈpa ddɯ ʁa] → [ˈpad. dɯ. ʁa]

b. [ˈfuɡgi] ‘flying fox’

(Input: /fu/ ‘meat’ + /gi/ ‘black’ = ‘black meat’)

[fu. gi] → [fu ggi] → [ˈfug. gi]

(121) Other similar examples are,

a. [ˈhup.pi] ‘a village’

b. [ˈkun.nu] ‘stone’

c. [ˈfuh.hu] ‘wild boar’

d. [ɯ.ˈfuʃ.ʃɯ.] ‘earhole’

A full list of all the consonants that undergo post-stress gemination is given in Table 5.15. The table shows that all simplex consonants except /ʂ, ʐ, ɲ, ʎ, ʁ/ undergo

gemination. The reason for this is not clear. One cannot rule out gaps in the data, especially as regards /ʁ/, since its voiceless counterpart /χ/ is geminated.

5.5 Summary and Discussion

The table below summarizes the consonant behaviour in Hrusso Aka words and syllables.

Table 5.15: Summary of Cluster types at surface level syllabification

Doculects **Cluster type**	**Inventory**
Branching onset	pʃ, pʂ, bʒ, bzˌ, ts, tʂ, dʒ, dzˌ, kʃ, kʂ, gʒ, gzˌgʒ, fʃ, vʒ, mzˌ(?) st (?),
Triple branching onset	
Word final consonant	m, ɲ, ʎ
Complex coda	
Sonority violating onset	mzˌ(?), st (?)
Sonority violating coda	
Word-Internal geminates	pp, bb, tt, dd, ll, ss, ʃʃ, mm, nn, kk, gg
Homorganic word internal clusters	**Onset**: ts, tʂ, dz, dzˌ, t͡ʃ , d͡ʒ **Cross-syllabic**: n.d, m.b, st (?), l.t, n.t, ŋ.k, g.w, ɲ.d͡ʒʲ, ɲ. t͡ʃʲ
Heterorganic word internal clusters	**Onset**: ps, pʃ, bʒ, bzˌ, kʃ, kʂ, gʒ, gzˌ mzˌ, vʒ, vzˌ, pʂ, wɲ, fʃ, fʂ **Cross-syllabic:** m.t͡ʃ, m.s, k.ʎ, m.d͡z, m.d, m.ɲ m.g, l.g, m.n, l.h, m.bzˌ, l.d͡ʒʲ, m.tʂ, m.k, g.d, n.t͡ʃ, b.l, l.v, g.dzˌ, m.t͡s, m.gʒ, m.l, l.bzˌ, ɲ.g, k.t͡s, n.t͡ʃʲ, n.dzˌ, m.t, ʃ.m, l.t͡ʃ, m.ʃ, n.d͡ʒ, m.dzˌ, k.t
Rising word internal clusters	**Onset:** ps, pʃ, bʒ, bzˌ, dz, dzˌ, t͡ʃ , d͡ʒ, kʃ, kʂ, gʒ, gzˌ mzˌ, vʒ, vzˌ, pʂ, wɲ, fʃ, fʂ **Cross-syllabic**: k.ʎ, b.l, m.l, g.w, ʃ.m, t.n
Falling word internal clusters	**Onset**: st (?) **Cross-syllabic**: m.b, m.s, m.ʃ, m.t, m.d, m.g, m.k, m.dz, m.ts, st (?),l.t, l.g, l.h, l.d͡ʒʲ, n.d͡ʒ, n.t͡ʃ, n.t, n.d, ŋ.k, l.v, n.t͡ʃʲ, m.t͡ʃ, , ɲ.d͡ʒʲ, l.t͡ʃ,
Sonority plateaus ?	**Onset: ---** **Cross-syllabic:** k.t, g.d

The table again shows that the language allows only special type of branching onsets, that is, obstruent-sibilant clusters which are composed of the segments shown below.

(122) Hrusso Aka Onsets

	ʃ	ʒ	ʂ	ʐ
p	+	-	+	-
t	+	-	+	-
k	+	-	+	-
f	+	-	+	-
b	-	+	-	+
d	-	+	-	+
g	-	+	-	+
v	-	+	-	+
m	-	-	-	+

The /s/-C and /ʃ/-C consonant clusters pose a special problem is the above assertion is true. Their status is investigated in section 7.4.

Stress-related gemination is a commonly attested phenomenon (Ringen & Vago 2011). Though a common function of syllable closure due to gemination is to add weight to the syllable, this need not always be so (Lahiri & Koreman 1988; E. Selkirk 1990; Ringen & Vago 2011). Another function of geminate coda is to provide length as Ringen & Vago point out in the case of Taz Selkup stress (p. 158). It is not clear what function gemination serves in Hrusso Aka. In this study I have only noted the phenomenon of

post-stress gemination without analysing it any further. A study of Hrusso Aka gemination from intralinguistic and crosslinguistic perspectives needs further investigation.

As for sonority based behaviour, it is clear from the table that syllable-internally Hrusso Aka strictly observes SSP. Even the /mʐ/ cluster, which appears to violate SSP, does not do so in its surface representation, since the underlying /mʐ/ is phonetically realized as [mɻ].

In this chapter I have given an overview of the Hrusso Aka syllable structure and a very brief preliminary investigation of stress. This study will pave the way for a deeper look into the prosodic phenomena in the language in terms of rhythm in stress-timing, syllable-stress interaction and intonation. What exactly is the function of gemination? Why is it that only /m/, /ʎ/ and /ɲ/ are allowed in word-final codas, and why is it that /m/ is a highly preferred coda compared to others at the surface level? Apart from stress marking, what are the other functions of tone in the language?[46] These are some questions for further investigation.

[46] At least one case of grammatical function of tone is evident. H tone denotes object and L, subject in a sentence like /no i zeda/ literally 'I he scold'. If /no/ 'I' and /i/ 'he' have HL sequence, the sentence means 'he scolded me', whereas in LH sequence the same sentence means I scolded him.

Chapter 6. Consonant Sequences in Hrusso Aka

Clusters, Affricates or Complex Segments?

6.0 Introduction

This chapter aims to investigate consonantal complexity in Hrusso Aka Phonology, which is an important issue due to the ubiquitous inventory of consonants showing various degrees of complexity. Between what are clearly simple consonants on the one hand and clear-cut clusters on the other, there are also ambiguous consonantal segments in the language; I shall discuss these segments here. This chapter will have four sections. First, a clarification of terminology regarding consonantal complexity, second, a discussion on the Hrusso Aka consonant sequences and third, a discussion on whether the ambiguous segments are clusters or single units. In the fourth section I shall discuss the status of /s/-C sequences.

6.1 Terminology

Since there is a lack of agreement in the literature on terminology used for various types of consonantal complexity, I shall first of all clarify terminology used in this study.

6.1.1 Complex vs simple consonantal segments:

Consonantal complexity is "non-homogeneous internal phonetic structure" in a consonantal segment that is phonologically a single unit(Weijer (1994 p. 49). Internal phonetic complexity means that the segment in question has internal parts that are realized differently from one another. Thus consonants with secondary articulation such as [p^j], affricates such as [t͡s], labio-velar stops such as [k͡p], and pre-nasalized stops [^{n}d] (p.49) are complex segments in Weijer's terminology.

Simple consonantal segments are those that have homogeneous internal composition. Consonantal segments like [k], [l], [m], and [d] are simple.

6.1.2 Consonant clusters vs Complex Segments

Vennemann (2012 p. 13) defines the consonant cluster as an uninterrupted sequence of two or more consonants. In other words, they are sequences of "marginal speech sounds"; speech sounds uninterrupted by a syllable nucleus. Thus CC, C.C, CCC, CC.C, and C.CC are consonant clusters whereas CVC, CV.C, CVCC, CCVC, CCVCC are not. A caveat is needed here. This definition does not clarify how complex segments, which can be considered as underlyingly involving two sequential consonants, are different from clusters. A clearer definition of consonant clusters would be to say that they are uninterrupted sequences of independent consonantal segments. 'C' therefore, would stand for either a simple or a complex consonantal segment.

6.1.3 Affricates

Affricates are complex consonantal segments that are internally composed of stop-fricative parts in that order. The discussion on affricates begins in modern phonological theory with them being considered as stops with added features. Jakobson, Fant and Halle (1952) considered them as stops with an added [+strident] feature. Pointing out that certain affricates such as Chipewyan [tθ] are not strident, *SPE* introduced the feature [delayed release] to distinguish them from simple stops. In recent times, researchers like Rubach (1994) and Steriade (1989) and Lin (2011) have argued for the interpretation of the affricates as stops.

A weakness of theories that consider affricates as stops, as Lombardi (1990) points out, is that they fail to explain the 'edge effects' where they behave as fricatives on the right edge. Clements and Keyser (1983) proposed, within the Autosegmental framework, that affricates are two separate segments linked directly to the x slot. Lombardi (1990), citing Prince and McCarthy (1990) points out that this cannot be the case due to the single unit behaviour of affricates as regards melody.

Scholars further disagree on whether the constituents of an affricate should share the same place node. For Sagey (1986) and Lombardi (1990) affricates are composed of only homorganic stop-fricative sequences. Others consider all stop-fricative sequences that act as single consonantal segment behaviour as affricates. Johnson (2012 p. 179) says that homorganicity cannot be the defining characteristic of affricates, since there is enough cross-linguistic evidence for heterorganic affricates. Various scholars have attested for heterorganic affricates in different languages, for example, Aghem [pf] and [bv], and the Noni [tf] and [kf] (L. M. Hyman 1979, 1981) and Navajo [t^x] (McDonough & Ladefoged 1993). Prinz and Wiese (1991) have argued that the German [ks] and [ps] are affricates. Duanmu (2009 p. 28) points out that the affricate interpretations of the Standard Chinese [p^x], German [ps] and [ks], and Hindi [kʃ] are relevant to the syllable analysis of these languages.

In the midst of the controversy surrounding the nature of affricates, Hrusso Aka provides an interesting case study. Its series of obstruent-sibilant sequences behave both like clusters and single units and thus can be interpreted as clusters or affricates (homorganic as well as heterorganic). I shall discuss this in the following secton.

6.2 Consonant sequences in Hrusso Aka

Hrusso Aka consonantal sequences can be divided into those that can occur heterosyllabically, and those that are strictly tautosyllabic. Examples for the former are,

(123) /m/.C sequences

a. [sɯm.fu] ‘wild animal’

b. [dam.bo] ‘likewise’

c. [pom.ʁɯ] ‘fifty’

(124) /l/.C sequences

a. [ɯl.du] ‘muscle’

b. [ɯl.gɯ] ‘seed’

c. [hu.mil.zɯ] ‘firefly’

These are clearly heterosyllabic clusters; they originate during resyllabification. Their formation and phonotactics has been discussed in section 5.4.

6.2.1 Tautosyllabic consonant sequences

Hrusso Aka has three distinct series of tautosyllabic consonant sequences. I shall call them *Palatalization Series (PS), [C]-Sibilant series 1(CS1)* and *[C]-sibilant Series 2 (CS2).*

6.2.2 The Palatalization Series (PS)

(125) [C] + [j] → [C^{j}]

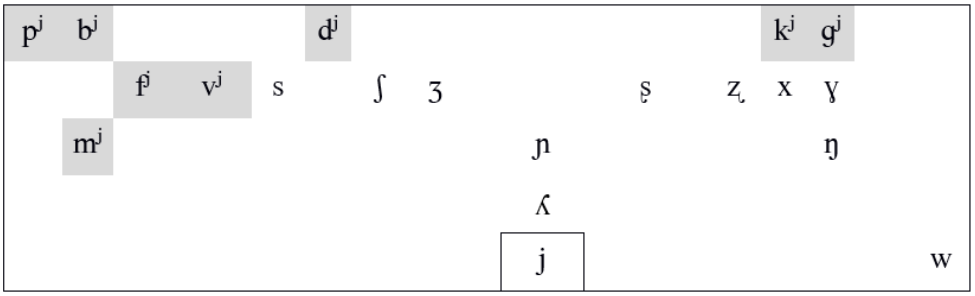
Where [C] is [PL] or [LABIAL]

Eg:

a. k + j → k^j

b. v + j → v^j

Figure 12: Palatalization series inventory



In the above figure the shaded region shows the span of palatalization on the basic consonant chart of Hrusso Aka. The box shows the second consonant participating in the series formation.

The table below shows the distribution of [C^j] series consonants against vowels. It is clear that [C^j] is found only when stops, fricatives and the bilabial nasal are followed by the vowel /e/. Further, there is no contrast between [C] and [C^j] in Hrusso Aka in the environment __ [e]. [47] These facts strongly indicate allophony between [C] and [C^j].

[47] Where x stands for [C] or [C^j].

Table 6.16 [C^{j}] distribution chart

	_i	**_e**	**_o**	**_ɯ**	**_u**	**_a**	**i_**	**e_**	**o_**	**ɯ_**	**u_**	**a_**	**#_**	**_#**	**+_+**[48]
p^{j}	-	+	+	-	-	-	+	+	+	+	+	+	+	-	+
b^{j}	-	+	+	-	+	-	+	+	+	+	+	+	+	-	+
d^{j}	-	+	+	-	-	-	+	+	+	+	+	+	+	-	+
k^{j}	-	+	+	-	-	-	+	+	+	+	+	+	+	-	+
g^{j}	-	+	+	-	-	-	+	+	+	+	+	+	+	-	+
m^{j}	-	+	+	-	-	+	+	+	+	+	+	+	+	-	+
f^{j}	-	-	-	-	+	-	-	-	-	-	-	-	+	-	-
v^{j}	-	+	+	-	+	-	-	+	-	+	+	+	+	-	+

(126) Examples

a. [p^{j}e] ‘vegetable’

b. [b^{j}e] ‘forest’

c. [k^{j}e] ‘when’

d. [g^{j}e] ‘cloth’

[48] Word medial

However, this is not so straightforward, since there is contrast between [C] and [C^{j}] in the environment [x]/___ɤw.

(127) [C] - [C^{j}] contrast

a. [pɤw] ‘receive’ [p^{j}ɤw] ‘pick’

b. [kɤw] ‘go’ [k^{j}ɤw] ‘cough’

c. [nɤw] ‘pain’ [b^{j}ow] ‘sprout’

d. [dɤw] ‘do’ [d^{j}ɤw] ‘big’

Morphological analysis of these words shows that the palatalization here is due to the morpho-phonological process of vowel interaction rather than consonant contrast. For example,

(128) [pa + -w] → [pɤw] [p^{j}e + -w → [p^{j}ɤw]

(129) [ka + -w] → [kɤw] [k^{j}e + -w] → [k^{j}ɤw]

The process can be explained through the following derivation.

(130) An analysis of [pɤw] ‘get.NOM’ and [p^{j}ow] ‘set fire.NOM’

words		[pɤu] ‘get.NOM’	[pʲou] ‘set fire.NOM’
UR		/pa/ /-w/	/pe/ /-w/
		↓	↓
Palatalization	[C] → [Cʲ] / _e	------	pʲe -w
		↓	↓
Labial spreading	See sec. 4.2.1.2	pɤw	pʲɤw
		↓	↓
SR		[pɤw]	[pʲɤw]

Therefore, the members of the PS series that is, the palatalized consonants, do not have an independent phonemic status in Hrusso Aka. They are actually allophones of their non-palatalized counterparts.

6.2.3 [C]-Sibilant Series:

Two distinct series of consonant sequences having CC structure are found in Hrusso Aka. The first consonant is either a stop or a labial fricative or in one instance, a bilabial nasal. I shall call them CS1 and CS2 as mentioned above. They are underlyingly formed by the following mechanism:

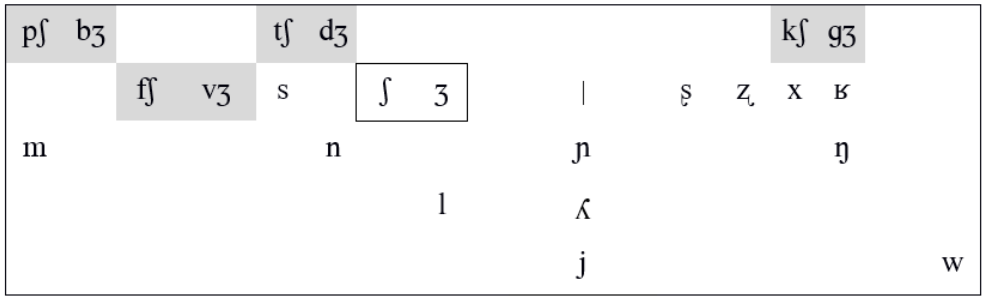
(131) $CS1: [x] + \begin{bmatrix} STRI \\ HIGH \\ ATR \end{bmatrix}$

Where x = plosive /p, t, k, b, d, g/ or labial fricative /f/, /v/

Eg. a. p + ʃ → /pʃ/

b. g + ʒ → /gʒ/

Figure 13: [STOP] + [ʃ] [ʒ]



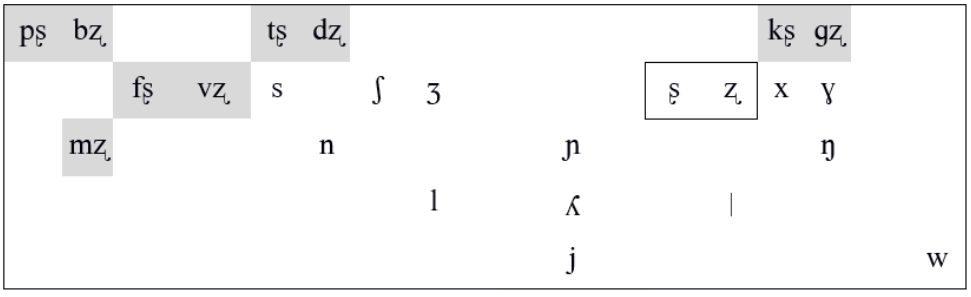
(132) CC2: [x] + $\begin{bmatrix} \text{STRI} \\ \text{HIGH} \\ \text{RTR} \end{bmatrix}$

Where x = plosive /p, t, k, b, d, g/ or labial fricative /f, v/, or bilabial nasal /m/.

Eg. a. m + ʐ →/mʐ/

b. k + ʂ → /kʂ/

Figure 14 [STOP/FRIC/m] + [ʂ] [ʐ]



6.3 Single segments or clusters?

Consonant sequences in CS1 and CS2 pose some difficulty in analysis as regards their single-consonant or cluster status, since they are often perceived as single segments by native speakers. I shall discuss this issue below, citing various pieces of evidence. However, as is clear from the previous chapter, for the purposes of this study I have analysed them as onset clusters. For a preliminary study like this, such a position affords ease of analysis and economy (Burquest 2006 pp. 164–168). If one were to analyse them as single consonantal units, not only would the consonantal inventory would increase enormously, but also such an analysis would become more difficult, given the debate on the nature of affricates discussed above. (Also Cf. Kenstowicz 1994 pp. 499–505; Weijer 1994; Duanmu 2002, 2009; Lin 2011 for accounts of debate on this matter).

6.3.1 Why this question is important

However, some attention is due to the question of how these clusters are psychologically perceived by the native speakers. I consider this an important question for two reasons. These reasons arise from the goals of this study I stated in the introduction. The first goal, that this study should benefit the language speaking community, demands that the data should be carefully analysed from their point of view. There is evidence, which I shall discuss below, that they often see these clusters as single segments, and for this reason I propose that their intuition should receive serious consideration. By failing to pay attention to native speaker intuition one not only risks the loss of valuable insights, but also may end

up with analysis that will create difficulties for them as regards orthography and language development. Secondly, in terms of contribution to the phonological research, Hrusso Aka, with its rich and complex consonant inventory provides an opportunity to enrich the debate on the nature of consonant clusters, affricates and complex segments.

Although I have taken a position in this study that CS1 and CS2 are onset clusters, I shall present below some observations that either support or give counterevidence to this fact. The aim of this is to raise questions for further research on these consonant sequences.

6.3.2 Onset clusters: A syllable inversion game

A word game played by children in some Hrusso Aka villages confirms that CS sequences are allowed only in onsets. The game involves mirror imaging words by syllable inversion as follows:

(133) Pattern of the syllable inversion game

a. /sɯndade/ /dedasɯn/ ‘therefore’

b. /kameɲe/ /ɲemeka/ ‘having come’

Here one finds that the CS sequences are never divided across syllables.

(134) Words with CS sequences

a. /labzɯɲ/ /bzɯɲ.la/ ‘lentil’

b. /ɯ.tʂɯ/ /tʂɯ.ʔɯ/ ‘skin’

c. /ɲukʃu/ /kʃu.ɲu/ ‘outsider’

d. /dʐubzɯ/ /bzɯ.dʐu/ ‘pumpkin’

Note that the CS1 and CS2 sequences are kept always undivided and they occur only in onsets in all instances. Other possible answers to (134) b., c. and d. as shown below are rejected as unnatural by native speakers.

(135) Wrong formulations

a.	/ɯ.tʂɯ/	*/ʂɯ.ɯt/	‘skin’
b.	/ɲukʃu/	*/ʃu.ɲuk/	‘outsider’
c.	/dʐubzɯ/	*/ zɯ.dʐub/	‘pumpkin’

Results for words involving non-CS sequences are:

(136) Non-CS consonant sequences

a.	/kambo/	/bo.kam/	*/mbo.ka/	‘proper name’
b.	/sɯndade/	/de.da.sɯn/	*/de.nda.sɯ/	‘therefore’
c.	/ɯmbʲo/	/bʲo.ɯm/	*/mbʲo.ɯ/	‘gun’
d.	/fumsu/	/su.fum/	*/msu.fu/	‘wolf’

Thus it was observed that the breaking up of consonant sequences during the word game applies to all possible consonant clusters except CS sequences. The CS sequences were always kept together, and in the onset.

6.3.3 Onset Clusters*: Ka-* insertion Game

This game involves the insertion of the syllable ‘*ka*’ before every syllable in a word. For visual clarity I shall put the syllables obtained by the participants in boldface:

(137) Word game involving insertion of *ka*.

a.	/aki/	/ka.ʔ**a**.ka.**ki**/	‘uncle’
b.	/ʂandzɻabu/	/ka.**ʂan**.ka.**dzɻa**.ka.**bu**/	a proper name
c.	/avampʂa/	/ka.**a**.ka.**vam**.ka.**pʂa**/	‘ladle’
d.	/mukʂom/	/ka.**mu**.ka.**kʂom**/	‘old woman’
e.	/kapʃɲe/	/ka.**ka**.ka.**pʃe**.ka.**ɲe**/	‘having passed by’

In both the word games above CS sequences remain firmly undivided, and are assigned only to the onset, confirming the onset-only position assigned to them in the last chapter on the syllable.

6.3.4 Are CS sequences separable? A vowel insertion experiment

Vowel insertion experiment can be a good indicator of whether native speakers of a language perceive a given consonantal sequence as one or two units. Tsakosta and Vis (2009) cite an experiment that demonstrates how native speakers of Greek distinguish between true clusters and affricates. The speakers were given a set of test words containing both true clusters and affricates and asked to insert vowels between consonants wherever they felt that a vowel could be inserted. It was expected that if the speakers perceived consonant sequences as clusters, then they would insert a vowel between them; on the contrary, if they perceived a given sequence as a single unbreakable units, they would not do so.

For example, the word /proi/ would have two possibilities. If the native speakers perceived the first two consonants as a cluster, then the test result would be

/proí/ → [po.ro.í]

If /pr/ were to be seen as a single segment, then the result would be,

/proí/ → [pro.i]

The test words contained Greek affricates /ts/ and /dz/; cons+/s/ sequences like /ps/ and /ks/; and /s/+cons sequences like /st/ and /sθ/. The results showed that the native speakers tended to keep the affricates unbroken whereas vowels were easily inserted between the consonants of a true cluster. The greatest coherence was found in the case of the homorganic affricates /ts/ and /dz/ and the least, with the /s/+cons sequences. There was ambiguity in the case of /ps/ and /ks/, and the authors attribute this to orthography, where these sequences are written with a single letter of the Greek alphabet ψ and ξ respectively, thus influencing the participants to think of them as single segments.

The following conclusions by the authors are helpful for the study of Hrusso Aka CS sequences:

a. Native speakers tend to insert epenthetic vowels more easily between the consonants of a true cluster than those of a complex segment, since they perceive the latter as a single segment.

b. Orthography can influence their interpretation of consonant sequences as single segments or clusters.

c. Homorganicity of affricates is a factor in their higher coherence; and the reason why cons+/s/ sequences are less coherent than the affricates is because they are heterorganic. This is relevant in Hrusso Aka CS sequences, since a significant number of them are heterorganic. If the heterorganic sequences stay together, it would be an evidence for a single segment interpretation.

To test the Hrusso Aka CS cohesiveness a sample study was conducted involving four language resource persons. They were asked to utter sentences containing test words as slowly as possible. Hrusso Aka native speakers usually insert the vowel /ɯ/ in slow speech or songs, in order to separate segments where possible. The hypothesis behind this task was that if speech is considerably slowed down, the /ɯ/ vowel would show up between the consonants of the clusters, but fail to separate sequences that are perceived as single segments.

In each case the task clearly showed two trends:

a. There was no vowel insertion between the constituent members of CS sequences.
b. There was clear /ɯ/ insertion between all other consonant sequences.

This is illustrated through the following sentence used in the experiment[49]:

(138)

/ɲe**dz**ɯʃːɯbamːe	nogɯ**dz**ɯ	aɲe	ka**kʃ**ow/
rain.if	muck	much	originate

If it rains, there will be much muck.

The words in this sentences were uttered in extremely slow speech as

(139)

a. ɲe-**dz**ɯ-ʃːɯ-bamː-me

[49] Parts in bold are the consonant sequences that were tested. I shall not tabulate the results here, since the sample was small and only indicative, and the results were all clear-cut as explained here. A study with a bigger sample in required.

b. no-gɯ-**dz**-ɯ

c. a-ɲe

d. ka-**kɯ**-ʎow

Note that there was a /ɯ/ insertion only in (139) d. and not in a. and b. Similar results were obtained for the test words shown below[50]:

(140) No /ɯ/ insertion:

a.	/ʃe**dʒ**e/	/ʃe-**dʒ**e/	'leaf'
b.	/ɲe**kʃ**ɯ/	/ɲe-**kʃ**ɯ/	'sweet potato'
c.	/dɯ-**gɻ**ɯ/	/dɯ- **gɻ**ɯ/	'stamp'
d.	/**dɻ**ʉ**bʒ**/	/**dɻ**ʉ-**bʒ**ɯ/	'pumpkin'
e.	/ʃe**dʒ**e/	/ʃe-**dʒ**e/	'leaf'
f.	/sbʲe**ts**ɯ/	/sɯ-bʲe-**ts**ɯ/	'corn beer'

(141) /ɯ/ insertion

a.	/bi**sk**ut/	/bi-sɯ-kut/	'biscuit'
b.	/pa**tl**oŋ/	/pa-**tɯ-l**oŋ/	'trousers'
c.	/sto/	/sɯto/	'attic'

[50] This is a representative list, containing only some of the test words used. I am not tabulating the results here, because the results were completely one sided. Of the 50 tokens tested with 4 speakers, a CS sequence was not broken even once! These tests have been informally performed with other native speakers with the same results. All that can be said as of now is that there is evidence that the CS sequences are never broken up by the native speakers. I shall leave the task of more rigorous testing of this fact for a future study.

d. /**st**uyi/ /sɯ-tu-yi/ ‘playing’

e. /upo**st**u/ /u-po-sɯ-tu/ ‘shoulder’

f. /ŋe**lts**ɯ/ /ŋe-lɯ-tsɯ/ ‘roof’

From the above results the following tentative conclusions can be drawn about the Hrusso Aka CS sequences:

a. The components of the members of CS series 1 and 2 are extremely coherent, and the experiment shows that they are never broken up by native speakers, indicating that they may be perceived as single segments.
b. All consonant sequences other than CS and except those mentioned in d. below are invariably broken up by /ɯ/ insertion in slow speech.

6.3.5 Proper name spellings: Evidence for single-segment perception?

Hrusso Akas have traditionally written their names in the English alphabet for official purposes.[51] The CS sequences are usually written with monographs as the following names of persons and places shows:

(142) Proper names

	Phonemic	**Conventional writing**
a.	/gɯbʒɯ/	Gibi
b.	/tagʒe/	Tage/Tagi

[51] This convention existed before I introduced the new orthography in 1999, in which ACS are written as digraphs.

c. /mʐali/ Miali

d. /gʒɯdu/ Gidu

e. /ʃɯgʒɯ/ Sigi/Shigi

The coronal CS are written using ‘ch’ and ‘j’, which are affricates /t͡ʃ/ and /d͡ʒ/ in English and Hindi and therefore, familiar to Hrusso Akas as single segments.

(143)

a. /pintʂu/ Pinchu

b. /mɯdza/ Mija

c. /atsum/ Achum

d. /nidʐam/ Nijam

The spelling convention of proper nouns once again points to single segment interpretation of CS sequences. The reduction of sequences like /gʒ/ and /bʒ/ to ‘g’ and ‘b’ points to the fact that the native speakers have traditionally considered them single segments, and this has prevented them from using digraphs to represent them.

Counter examples among proper names do exist, but they are relatively rare. For example, an alternant for /gɯbʒɯ/ is Gibji. But there is only one person named this way, and moreover, the spelling might have been influenced by the fact that he hails from a more educated family.

6.3.6 The breakable loans

Loanword analysis can offer insights into syllabification and cluster behaviour (Sagey 1986). To see how loanwords behave in Hrusso Aka, language games cited above were played with loanwords listed below with four native speakers. In each case the following results were obtained.

(144) Syllable Inversion game

a. /bakʃa/ 'box' from Hindi 'baksa'[52] /ʃa.bak/

b. /rokʃi/ 'arrack' /ʃi.rok/

(145) *–ka* insertion game

a. /baksa/ /ka.**bak**.ka.**sa**/

b. /rokʃi/ /ka.**rok**.ka.**ʃi**/

Note that as already stated, CVC syllables are strongly disfavoured in Hrusso Aka except CV[m ɲ ʎ]. Furthermore, there are no conditions in these words where high vowel deletion rules apply and give rise to coda formation. Therefore, the expected syllable formation would be like that in (134)c.

(146) *ba.kʃa

(147) *ro.kʃi

[52] Which in turn is a loan from English 'box.'

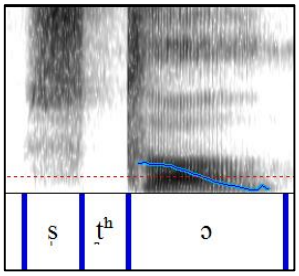
If indeed Hrusso Aka had onset clusters, there is no reason why in (144) and (145) a less favoured syllable structure is chosen over what should be a natural one as in (146). A plausible explanation to this anomaly is that native speakers consider /kʃ/ sequence in the loan word a cluster, and the native /kʃ/ sequences single segments.

To further test the validity of this analysis, tests will have to be conducted with more loan words and more speakers. I also expect that loan words that have been there in the language for long time and have 'gone native' should behave like native words, and the newer words should behave like the words just cited. Moreover, in the vowel epenthesis experiment as in (139) and (141), there should appear an epenthetic vowel between the members of the loan word cluster. For the lack of easy access to native speakers at the moment I shall leave these tasks for future study.

6.4 Does Hrusso Aka have s-C onset clusters?

The problem: Hrusso Aka has /st/ and /sp/ sequences. Should these be classified s-C clusters? For example, in normal speech the word [sto] 'attic' is pronounced without an intervening vowel between the first two consonants as shown in the figure below.

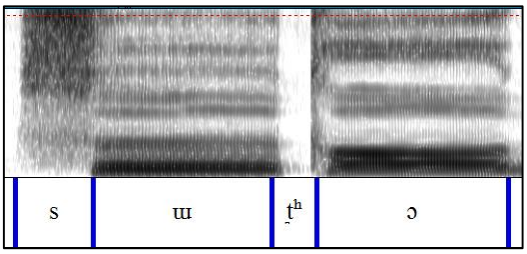
Figure 15: Pronunciation of [sn̪tʰɔ] in normal speech



Considering that /st/ clusters are cross-linguistically common and /s/ has unconventional behaviour in many languages, could this be interpreted as a s-C onset

cluster? To answer this, the word [sto] was tested for slow speech and syllable inversion game. In slow speech the epenthetic vowel /ɯ/ was inserted as shown below.

Figure 16: Pronunciation of [sʈʰɔ] in slow speech



In addition to the insertion of the epenthetic vowel, the syllable inversion game returns /tosɯ/ for /sto/, indicating that the word is disyllabic. A word involving a true onset cluster, that is a member of the CS series cannot be inverted this way. For example, /tʂo/ cannot be inverted as */oʂtɯ/. Secondly, there are other words with similar behaviour as /sto/. Therefore, sequences like s-C are false clusters in Hrusso Aka; the consonants are divided by a highly reduced and devoiced vowel /ɯ/.

	normal speech		**slow speech**	**syllable inversion**
False clusters				
(148)	[fta]	'fence'	[fɯta]	[tafɯ]
(149)	[ʂta]	'shoe'	[ʂɯta]	[taʂɯ]
True onset cluster:				
(150)	[tʂa]	'leave'	[tʂa]	---

Therefore, s-C sequence is clearly a result of the HVDv rule, where the high vowel /ɯ/ is devoiced and reduced, but not deleted. The syllable structure of words like /sto/ should be analysed as,

(151) Syllable structure of the false clusters

a. [**sɯ̥**to] attic CV.CV

b. [ɲe**tɯ̥**kʂɯ] bamboo wall CV.CV.CCV

c. [**fɯ̥**ta] fence CV.CV

d. [**ʂɯ̥**ta] shoe CV.CV

6.5 Conclusion

The preceding discussion indicates the possibility that the Hrusso Aka CS sequences might be single complex segments. The games and tasks above have been conducted with small groups of native speakers, and therefore are not conclusive. Even so, they indicate that the status of CS sequences is not a settled matter. Some questions that might be pursued in future are, what explains the strong cohesiveness of the CS sequences? Why are the loanword C-S sequences broken up even though they are similar to the native CS sequences, and in spite of the fact that the language disfavours codas? Do CS sequences show edge/anti-edge effects? What light do CS sequences shed on the 'clusters vs affricates vs complex segments' debate? How each of the constituent is affected by the other member within a CS sequence, (eg. the rhoticization of /ʐ̩/ in /mʐ̩/ to form [mɻ̩] output), and what length they occupy in the timing slot, and how they compare with the geminates? These are some of the questions that remain to be answered.

Conclusion

I set out on this study with two goals in mind, and both of them have been achieved in part. First of all, many issues in orthography have been resolved. With the discovery of the HVDv rule for example, it is now clear that the word for 'attic' is /s**ɯ**to/ and not /sto/. Similarly, /f**ɯ**ta/ 'fence' */fta/; /s**ɯ**tʂɯ/ 'needle' */stʂɯ/ etc., since the vowel /**ɯ**/ in these cases is merely reduced, not deleted. This study has also revealed that there are no /st/ clusters in that language, and the only onset clusters allowed are the CS clusters.

On the other hand, the HVDel rule clarifies that word for 'clean-do' is /da**gd**ʐaw/ and not */da**g**ɯ**d**ʐaw/ since the vowel /ɯ/, which was present in the root level /gɯdʐaw/ 'clean' has been actually deleted during resyllabification.

The study has revealed that the voiced uvular fricative /ʁ/ and the voiced uvular trill [ʀ] are allophones, and so are the voiceless uvular fricative [χ] and the voiceless glottal fricative [h].

Some clarity has been obtained on an intriguing alveopalatal puzzle. The native speakers make a phonemic distinction between very similar sounding [tʃ] vs [t̪ʃ], and [dʒ] vs [d̪ʒ]. A phonetic experiment that I conducted for a different study has clearly indicated that there is a phonemic contrast between these pairs of segments. This study has revealed that this distinction is justified, because one pair belongs to the alveopalatal consonants (sec. 2.2.2 -the plosive-like affricates $\widehat{\text{tʃ}}$ and $\widehat{\text{dʒ}}$) and the other to the CS1 clusters (sec. 6.2.3) This predicts that one will behave as a plosive and the other as a cluster. I have already noted the plosive-like behaviour of the first pair (sec. 2.2.2). This needs to be further tested with more specific data.

Working out the syllable structure and stress has given important insights into orthographical word boundaries and spellings. For example, there has been always a confusion as to which unit should be written as a word – morphological or phonological word. At times morphological words did not fit into the native speaker perception of a word. It was known that the phonological word would be a better alternative, but how to demarcate it was not known. This study reveals that stress defines a phonological word, and therefore, morphemes in a phonological word can be grouped together as one written word on the basis of stress. For example, */fu yo/ 'since yesterday' should be written as *fuyo* because /yo/ 'since' has no stress of its own. On the other hand, *se i* 'that one' should be left as it is, sine both /se/ and /i/ can stand alone, each with a stress of its own. A long string of morphemes like *daĝoke'jodawe* 'lookafter.IMP' is one single word since the whole morpheme complex has one stress marking.[53]

As for the second goal of identifying research questions that Hrusso Aka might raise, I shall list some that have come up. First of all, with the overall phonological system worked out, it should be easier to write the language consistently and I hope that a word list will soon be available for a comparison with other languages. The major hurdle in writing the language, the CS series, have been systematically worked out, and this should aid further research on the sound system of the language and its comparison with others in the neighbourhood.

[53] This word has six morphemes some of which can be independent words. /da/ 'do' ; /ʁo-/ 'sit'; /ke-/ 'INCL'; /-jo/ FUT; /da/ 'do'; and /-we/ IMP. If one divides the word according to the morphological boundaries, it is possible to write it as *da ĝokejo dawe*, but I have noticed that it is confusing to the native speakers.

The strong HVDv rule in the language opens up another avenue for phonological research in Hrusso Aka. It would be particularly interesting to see if the explanation I have offered here for the SG spreading applies to other vowel-devoicing languages like Japanese, Blackfoot and Oneida.

The application of the FUL model has afforded elegant and simple analysis most of the time, since it has been able to explain most of the phonological processes taken up for discussion in this thesis for example, the analysis of the HVDv rule. However, I have run into difficulty at times. For example, when a mid vowel and the low vowel behaved together as a group it has been difficult to find an explanation based on the minimal features FUL provides, whereas it would have been easier with binary features of [± high]. A deeper exploration of the FUL feature geometry needs to be done in order to further confirm the findings of this thesis and to work out a fuller feature system of Hrusso Aka. Lexical underspecification as posited by the FUL system is another area that needs to be explored more thoroughly in the language.

The interpretation of CS sequences as clusters has made their analysis simple and economical, but has left some interesting questions behind. Why do the native speakers perceive them as single segments? What does this fact tell us about their nature? Furthermore, how do CS sequences contribute to the cluster-complex segment-affricate debate?

Finally, Hrusso Aka prosody is yet to be studied. I have just made a beginning by studying the basic stress pattern, but other aspects of prosody like tone and intonation remain unexplored. Preliminary observation suggests that the language has 5-step intonantional register. It would be interesting to see how this interacts with the lexical tone. There is also

at least one case which seems to indicate that tone has a grammatical function (see footnote 46). The question as to whether the H-L distinction is privative or binary is also not clear at this stage, though I have analysed it as binary for the purposes of this study.

In conclusion, this study has revealed an overall picture of the Hrusso Aka phonology, clarified some issues of immediate relevance to the Hrusso Aka orthography, and raised many pertinent questions for further exploration.

****

APPENDIX 1

Stress analysis of Chuchuyi (Orchid) story.

Narrated by BN
Palizi, 23 June 2012

Rules of analysis are given in (103)on p. 86.

1	2	3	4	5
x * * * * * * * H L L H L fu. ba. ʎe. t͡ʃɯ. ssu̯.	x * * * * * * * H L L H L ba. d͡zɯ. ʎe. do. ʁi.	x * * H L t͡ʃi. t͡ʃʲo.	x * * * * * * H L H L ʂɯ. mz̥o. d͡zɯ. t͡ʂɯ.	x * * H L ɯ. t͡ʂɯ

6	7	8	9
x * * * * L H L t͡ʂu. d͡ʒʲoː. me	x * * * H L t͡ʃi. t͡ʃʲo.	x * * * * * * * H L H L L ʂɯ. mz̥o. d͡zɯ. t͡ʂɯ. me.	x * * * H L he ye.

10	11	12	13	14	15
x * * * * H L L fu. ba. je.	x * * * H L t͡ʃi. t͡ʃʲo.	x * * * * L H L nu. gou. fo.	x * * * * * L H L L ba. d͡zɯm. je. de.	x * * * * H L L ʂɯ. mz̥o. d͡zɯ.	x * * * H L i. t͡ʃʲeu.

16	17	18	19	20	21	22
x * * * * L H L i. ʎa. ʎe.	x * * * * L H L ɯ.ɲiɲ. je	x * * * H L b͡zo.v͡zɯ.	x * * * * L H L i. ja. ɲe.	x * * * * L H L i. ɲiɲ. je.	x * * * * L H L ʁu. ʎi. go.	x * * * H L a. ɲe.

23	24	25	26	27	28
x * * * L H ʁɯ.ʎim.	x * * * H L t͡ʃʲe. ɲe.	x * * * * L H L ʁu. ʎi. go.	x * * * H L a. ɲe.	x * * * * * * * H L L H L fu. ba. ʎe. t͡ʃɯ. ssɯ.	x * * * * * * * H L L H L ba. d͡zɯ. ʎe. do. ʁi.

29	30	31	32	33	34	35	36	37
x * * * H L na. kʃɯ.	x * * * * H L L a. ma. ɲum.	x * * * * L H L i. ja. ɲe.	x * * * * L H L ʁu. ʎi. go.	x * * * H L a. ɲe.	x * * * * H L L ma.ho.sːɯ.	x * * H t͡ʂum.	x * * H lɯm.	x * * * * H L L ma. ho. sːɯ.

38	39	40	41	42	43	44
x * * * * * * L H L H ma.t͡sa. kʲe. sːɯ.	x * * * H L lɯ. ha.	x * * * * H L L t͡sa. kʲe. me.	x * * * H L kɯ. ʎi.	x * * * * H L L ma. t͡sa. kʲe.	x * * * * H L L kɯ. ʎi. je.	x * * * * H L L sɯ.ji. me.

45	46	47	48	49	50	51	52
x * * * H L lɯ. ha.	x * * * H L ma. sːɯ.	x * * * H L a. ʂa.	x * * * * H L L t͡sa. kʲem. me.	x * * * L H a. ʂa.	x * * * * L L H ma. t͡sa. kʲe.	x * * * H L a. ʂa.	x * * * * H L L tu̯. kʲem. me.

53	54	55	56	57	58
x * * * L H a. ʂa.	x * * * * L L H ma. tu̯. kʲe	x * * * * L H L a. naː. da.	x * * * * L H L ɯ. ʎa. ʎo.	x * * * * H L L bz̥o. vʒɯ. ʁo.	x * * * * * * * H L L H L fu. ba. ʎe. t͡ʃɯ. sːɯ.

59	60	61	62	63	64	65
x * * * * * * H L L H L ba. d͡zɯ. ʌe. do. ʁi.	x * * * H L t͡ʃʲe.ɲe.	x * * * H L i. ʁe.	x * * * * H L L ɯ. ɲim. k͡ʃɯ.	x * * * * H L L ɲɯ. lɯ. vo.	x * * * * H L H u. fum. bo.	x * * * * H L L ma.ho. sːɯ.

66	67	68	69	70	71	72
x * * * * * * L H L H ma. t͡sa. kʲe. sːɯ.	x * * * * * L L H L ma. tu. kʲe. sːɯ.	x * * * * H L L a. hwa. je.	x * * * H L b͡ʐo. v͡ʒɯ.	x * * H i.	x * * * H L ɲu. k͡ʃum.	x * * * H L a.ʃɯm.

73	74	75	76	77	78	79	80
x * * * * L H L d͡ʒʲi. d͡ʒʲo. bi.	x * * * H L u. fum.	x * * H i.	x * * * * L H L t͡ʃʲep. pa. ʌe.	x * * H kɤi.	x * * H no.	x * * * H L ɲu. k͡ʃum.	x * * * * H L L a. ʃɯm. ge.

81	82	83	84	85	86	87
x * * * * L H L d͡ʒʲi. d͡ʒʲom. me.	* L ba	x * * * * H L L fu. ba. ɲe.	x * * * L H ba. d͡zɯm.	x * * * * L H L na. k͡ʃɯ. d͡ʒʲe.	x * * H u.	x * * * * * * * H L L H L L da. ʁo. kʲe.d͡ʒʲo. da. we.

88	89	90
x * * * * L H L t͡ʃʲe. ʌe. ɲe.	x * * * H L ɲu. k͡ʃʊ̯.	x * * * * * L L H L d͡ʒʲi. ʂʊ̯. k͡ʂa. ʌe.

APPENDIX 2

INFORMED CONSENT FORM

Name of the Researcher: XYZ

Department: Faculty of Linguistics, Philology and Phonetics

Course: MPhil

Supervisors: XYZ

Method of Obtaining Consent: Oral, on video and/or audio recording (Participants are illiterate or semiliterate)

Language of Obtaining Consent: Hrusso Aka or Hindi

Mr./Ms X,

I am an MPhil student at the University of Oxford, doing linguistic research on your language (Hrusso Aka). I am currently looking for phonological (i.e. the sound structure of your language) and syntactic (i.e. the grammar of your language) data for two research projects of mine. My research will involve interview with language consultants, which will be video and audio-recorded. I have approached you to be a language consultant since I have come to know that you are a knowledgeable person in your language.

The data that I intend to collect is primarily of linguistic nature. You are free to refuse to answer any question that you do not wish to. Audio and video recording will be made in quiet places in comfortable settings. You may ask to stop the interview or recording any time if you experience fatigue or discomfort without any adverse consequences thereof.

The data will be used for my own studies as well as for the future benefit of the Hrusso Aka language and for the advancement of knowledge in Linguistics. For this purpose, the data, both audio and video, will be stored in secure and reputed linguistic archives and might be put on the internet, audio or print media with proper acknowledgement of your valuable contribution. The data might also be used in future by me or other interested linguists or any other member of the Hrusso Aka community for the purposes just mentioned, with the permission of the copyright holders of the data (copyright holders will be decided after a discussion with the village leaders prior to the start of the interviews). Such dissemination of the data on internet will be done only for the benefit of the Hrusso Aka language and culture or the advancement of the field of Linguistics.. You have the right to withdraw any data you deem contrary to your interests at any time in future without any adverse consequences thereof.

I would like to assure you that this study proposal has been reviewed by, and received ethics clearance through the University of Oxford Central University Research Ethics Committee.

My interviews with you may of single/ multiple sessions, each session not exceeding two hours. You will be compensated adequately for your time which would amount up to Rs. 50 per hour or any other mutually agreed means or as per local customs as agreed upon by local leaders.

If you have a concern about any aspect of this project, please get in touch with me at ***.ox.ac.uk or my supervisor XYZ at ***@ling-phil.ox.ac.uk . We will do our best to answer your query within 10 days of the receipt of your query. Should you remain unsatisfied and have further concerns you could contact the chair of the Research Ethics Committee at

the University of Oxford (Chair, Social Sciences & Humanities Inter-Divisional Research Ethics Committee; Email: ethics@socsci.ox.ac.uk; Address: Research Services, University of Oxford, Wellington Square, Oxford OX1 2JD). The chair will seek to resolve the matter in a reasonably expeditious manner.

Before we proceed I wish to obtain your consent. If you have understood what I have just explained, and wish to participate, please say "Yes. I would like to participate" in Hrusso Aka/Hindi. This will be taken to mean that you consent to participate as a language informant in this research. (The participants do not understand English. The oral consent form will be orally explained in Hindi/Hrusso Aka and the consent obtained in the same language.)

References

Anderson, G., & Murmu, G. (2010). Preliminary notes on Koro, a 'hidden' language of Arunachal Pradesh. *Indian Journal of Linguistics*, 71: 1–32.

Anderson, J. D. (1896). *A short vocabulary of the Aka language*. Shillong.

Anderson, J. M. (1969). Syllabic or Non-Syllabic Phonology? *Journal of Linguisitcs*, 5: 136–42.

Austin, P. (2012). *Language Documentation and Meta-documentation*. Ms, SOAS, London.

Awedyk, W. (1975). *The Syllable Theory and Old English Phonology*. Wrocław: Zakład Narodowy Imienia Ossolinnskich, Wydawn. Polskiej Akademii Nauk.

Blench, R., & Mark Post. (2011). *(De)Classifying Arunachal Languages: Reconsidering the Evidence*. Ms.

——. (2014). Rethinking Sino-Tibetan Phylogeny from the Perspective of North East Indian Languages. Nathan Hill and T. Owen-Smith (ed.) *Trans-Himalayan Linguistics*, pp. pp.71–104. De Gruyter Mouton: Boston.

Blevins, J. (1993). A Tonal Analysis of Lithuanian Nominal Accent. *Language*, 69/2: 237–73.

——. (1995). The Syllable in Phonological Theory. Goldsmith J. A. (ed.) *The Handbook of Phonological Theory*, pp. 206–44. Blackwell Publishers: Oxford.

Bloomfield, L. (1935). *Language*. London,: G. Allen & Unwin.

Burquest, D. A. (2006). *Phonological Analysis: A Functional Approach*, 3rd ed. Dallas, Texas: SIL International.

Bybee, J. L., Chakraborti, P., Jung, D., & Scheibman, J. (1998). Prosody and segmental effect: some paths of evolution for word stress. *Studies in Language*, 22: 267–314.

Census of India. (2011). Arunachal Pradesh Population Census data 2011. *Population Census 2011*. Retrieved April 23, 2015, from <http://www.census2011.co.in/census/state/arunachal+pradesh.html>

Chomsky, N., & Halle, M. (1968). *The Sound Pattern of English*. New York: Harper & Row.

Clements, G. N. (1985). The Geometry of Phonological Features. *Phonology*, 2: 225–52.

——. (1989). *A Unified Set of Features for Consonants and Vowels*. Ms, Ithaca, NY.

——. (1990). The Role of the Sonority Cycle in Syllabification. Kingston J. & Beckman M. E. (eds) *Papers in Laboratory Phonology*, Vol. 1, pp. 283–333. Cambridge University Press: Cambridge.

Clements, G. N., & Hume, E. (1995). The Internal Organization of Speech Sounds. Goldsmith J. A. (ed.) *Handbook of Phonological Theory*, pp. 245–306. Blackwell Publishers: Oxford.

Clements, G. N., & Keyser, S. J. (1983). *CV Phonology: a Generative Theory of the Syllable*. Cambridge, MA: MIT Press.

Coleman, J. (1992). The phonetic interpretation of headed phonological structures containing overlapping constituents. *Phonology*, 9: 1–44.

——. (2001). The phonetics and phonology of Tashlhiyt Bereber syllabic consonants. *Transactions of the Philological Society*, 99: 29–64.

D'Souza, V. A., Nimasow, P., Rumo, A., & Gidusow, R. (2005). *Ako Na Kako (Children's Book)*. Palizi: St. Xavier's School.

Duanmu, S. (2002). Two Theories of Onset Clusters. *Chinese Phonology*, 11: 97–120.

——. (2009). *Syllable Structure: The Limits of Variation*. Oxford: Oxford University Press.

Ewen, C. J., & Hulst, H. van der. (2001). *The Phonological Structure of Words: An Introduction*. Cambridge: Cambridge University Press.

Fudge, E. (1969). Syllables. *Journal of Linguisitcs*, 5: 253–86.

——. (1987). Branching Structure within the Syllable. *Journal of Linguisitcs*, 23: 359–77.

Ghini, M. (2001). Place of Articualtion First. *Distinctive Feature Theory*, pp. 71–146. Mouton de Gruyter: Berlin.

Gick, B., Bliss, H., Michelson, K., & Radanov, B. (2012). Articulation without acoustics: 'Soundless' vowels in Oneida and Blackfoot. *Journal Of Phonetics*, 40/1: 46–53. DOI: 10.1016/j.wocn.2011.09.002

Goldsmith, J. A. (1976). *Autosegmental Phonology. Doctoral Dissertation*. New York: Garland Publishing, 1979.

Grierson, G. A. ed. (1909). *Linguistic survey of India*, Vols. 1-11, Vol. III,1. Tibeto-Burman family. Calcutta: Govt. of India, Central Publication Branch.

Halle, M. (1988). The Immanent Form of Phonemes. Hurst W. J. (ed.) *The Making of Cognitive Science*, pp. 167–83. Cambridge University Press: Cambridge.

——. (1992). Phonological Features. Bright W. (ed.) *International Encyclopedia of Linguistics*, Vol. 3, pp. 207–12. Oxford University Press: Oxford.

——. (1995). Feature Geometry and Feature Spreading. *Linguistic Inquiry*, 26: 1–46.

Halle, M., Vaux, B., & Wolfe, A. (2000). On Feature Spreading and the Representation of Place of Articulation. *Linguistic Inquiry*, 31: 387–444.

Halle, M., & Vergnaud, J.-R. (1980). Three Dimensional Phonology. *Journal of Linguisitc Research*, 1: 83–105.

——. (1987). *An Essay on Stress*. Cambrdige, Mass.: MIT Press.

Harris, J. W. (1983). *Syllable structure and stress in Spanish: a nonlinear analysis*. Cambridge, Mass.: MIT Press.

Hasegawa, Y. (1999). *Proceedings of the 14th International Congress of Phonetic Sciences*, pp. 523–6.

Hayes, B. (1989). Compensatory lengthening in moraic phonology. *Linguistic Inquiry*, 20: 253–306.

——. (1995). *Metrical Stress Theory: Principles and Case Studies*. Chicago: University of Chicago Press.

Hesselmeyer, C. H. (1868). The Hill Tribes of the Northern Frontier of Assam. *Journal of the Asiatic Society of Bengal*, 27: 192.

Hooper, J. B. (1972). The Syllable in Phonological Theory. *Language*, 48: 525–40.

Hulst, H. G. van der, & Ritter, N. A. (1999). Theories of the Syllable. Hulst H. G. van der & Nancy A. Ritter (eds) *The Syllable: Views and Facts*, Studies in Generative Grammar, Vol. 45, pp. 13–52. Mouton de Gruyter: Berlin.

Hyman, L. (1985). *A Theory of Phonological Weight*. Dordrecht: Foris Publications.

Hyman, L. M. (1979). *Aghem grammatical structure*. Los Angeles: Dept. of Linguistics, University of Southern California.

——. (1981). *Noni grammatical structure*. Los Angeles: Dept. of Linguistics, University of Southern California.

——. (2006). Word-Prosodic Typology. *Phonology*, 23/02: 225–57.

Jaeger, J. J. (1978). Speech aerodynamics and phonological universals. Jaeger J. J., Woodbury A. C., Ackerman F., Chlarello C., Gensler O. D., & Kingston J. (eds) *Proceedings of the Fourth Annual Meeting of the Berkeley Linguistics Society*, pp. 311–29. Berkeley: University of California.

Jakobson, R., Fant, G., & Halle, M. (1952). *Preliminaries of Speech Analysis*. Cambridge, MA: MIT Press.

Jespersen, O. (1904). *Lehrbuch der Phonetik*. Leipzig: B. G. Teubner.

Johnson, K. (2012). *Acoustic and Auditory Phonetics*. Chichester: Wiley-Blackwell.

Kahn, D. (1976). *Syllable Based Generalizations in English Phonology*. New York: Garland Publishing.

Kenstowicz, M. J. (1994). *Phonology in generative grammar*. Cambridge, MA: Blackwell.

Kohler, K. J. (1966). Is the Syllable a Phonological Universal? *Journal of Linguisitcs*, 2: 207–8.

Kondo, M. (1997). *Mechanism of Vowel Devoicing in Japanese*. University of Edinburgh, Edinburgh.

Konow, S. (1902). Note on the languages spoken between the Assam Valley and Tibet. *Journal of the Royal Asiatic Society*, 34/01: 127–37. DOI: 10.1017/S0035869X00157119

Kuryłowicz, J. (1948). Contribution á la théorie de la syllabe. *Biuletin Poskiego Towarszistwa Jezyko-Znawaczego*, 8: 80–113.

Ladefoged, P. (2003). *Phonetic Data Analysis*, 2010th ed. Oxford: Blackwell Publishing.

Ladefoged, Peter & Ian Maddieson. (1996). *The Sounds of the World's Languages*. Oxford: Blackwell Publishers.

Laeufer, C. (1985). *Some Language-specific and Universal Aspects of Syllable Structure and Syllabification: Evidence from French and German* (PhD dissertation). Cornell University.

Lahiri, A., & Evers, V. (1991). Palatalization and Coronality. Paradis C. & J. -F. Prunet (eds) *The Special Status of Coronals*, pp. 79–100. Academic Press: San Diego.

Lahiri, A., & Koreman, J. (1988). Syllable weight and quantity in Dutch. *Proceedings of the West Coast Conference on Formal Linguistics*, Vol. 7, pp. 217–28.

Lahiri, A., & Reetz, H. (2002). Underspecified Recognition. Gussenhoven C. & Warner N. (eds) *Papers in Laboratory Phonology 7*, pp. 637–76. Mouton de Gruyter: Berlin.

——. (2010). Distinctive Features: Phonological underspecification in representation and processing. *Journal of Phonetics*, 38: 44–59.

Lewis, M. P., Simons, G. F., & Fenning, C. D. (Eds). (2015). *Ethnologue: Languages of the World*, 18th ed. Dallas, Texas: SIL International.

Lin, Y.-H. (2011). Affricates. Oostendorp M. van, Ewen C. J., Hume E., & Rice K. (eds) *The Blackwell Companion to Phonology Vol 1*, Blackwell Companions to Linguistics. Wiley-Blackwell: Malden, MA.

Lombardi, L. (1990). The nonlinear organization of the affricate. *Natural Language & Linguistic Theory*, 8/3: 375–425. DOI: 10.1007/BF00135619

McCarthy, J. (1988). Feature Geometry and Dependency: A Review. *Phonetica*, 43: 84–108.

McCarthy, J., & Prince, A. S. (1986). *Prosodic Morphology*. Ms, University of Massachusetts and Brandeis.

——. (1990). Foot and Word in Prosodic Morphology:The Arabic Broken Plural. *Natural Language & Linguistic Theory*, 8/2: 209–83.

McDonough, J., & Ladefoged, P. (1993). Novajo Stops. *UCLA Working Papers in Phonetics*, 83: 19–33.

Nespor, M., & Vogel, I. (2007). *Prosodic Phonology*. Studies in Generative Grammar, Vol. 28. Berlin: Mouton de Gruyter.

Nimachow, G. (2011). *The Akas: Land and People*. Delhi: Commonwealth Publishers.

Ogasawara, N. (2013). Lexical representation of Japanese vowel devoicing. *Language and Speech*, 1: 5–22. DOI: 10.1177/0023830911434118

Pike, K. L. (1947). *Phonemics, a Technique for Reducing Languages to Writing*. Ann Arbor: University of Michigan Press.

——. (1967). *Language in Relation to a Unified Theory of the Structure of Human Behavior*. The Hague: Mouton.

Pike, K. L., & Pike, E. V. (1947). Immediate constituents of Mazatec syllables. *International Journal of American Linguistics*, 13: 78–91.

Prinz, M., & Richard Wiese. (1991). Die Affrikaten des Deutschen und ihre Verschriftung. *linguistische Berichte*, 133: 165–89.

Pulleyblank, D. (1986). *Tone in Lexical Phonology*. Dordrecht: D. Reidel.

Ringen, C., & Vago, R. M. (2011). Geminates: heavy or long? Cairns C. E. & Raimy E. (eds) *Handbook of the syllable*, pp. 155–69. Brill: Leiden.

Rubach, J. (1994). Affricates as Strident Stops in Polish. *Linguistic Inquiry*, 25/1: 119–43.

Rumo, A., Nimasow, P., & D'Souza, V. A. (1999). *Cho Akonawa, Thougyou I Nilvogo Nuĝubo (A Prayerbook for Children)*. Palizi: St. Xavier's School.

Sagey, E. (1986). *The Representaion of Fearures and Relations in Non-Linear Phonology*. MIT, Cambridge, MA.

Schubert, J. (1964). Hrusso-Vokabular. *Mitteilungen des Instituts for Orientforsehung*, Vol. 10, pp. 295–350. Berlin: Deutsche Akademie der Wissenschaften zu Berlin.

Selkirk, E. (1990). The two root theory of length. *University of Massachusetts Occasional Papers in Linguistics*, Vol. 14, pp. 143–71.

Selkirk, E. O. (1982). The Syllable. Harry G. van der Hulst & Norval Smith (eds) *Structure of Phonological Representation: Part 2*, pp. 337–84. Foris Publications: Dordrecht.

Shafer, R. (1947). Hruso. *Bulletin of the School of Oriental and African Studies*, 12: 184–96.

——. (1955). Classification of the Sino-Tibetan languages. *Word*, 11: 94–111.

Shibatani, M. (1973). The Role of Surface Phonetic Constraints in Gererative Phonology. *Language*, 49: 87–106.

Sievers, E. (1881). *Grundzüge der Phonetik*. Leipzig: Breitkopf und Härtel.

Siewierska, A. (2013). Person Marking. Song J. J. (ed.) *The Oxford Handbook of Linguistic Typology*, pp. 322–45. Oxford University Press.

Simon, I. M. (1970). *Aka Language Guide*. Itanagar: Directorate of Research.

Singh, S. S. (2013). Arunachal has 90 languages, says survey. *The Hindu*. Kolkata.

Sinha, R. (1962). *The Akas, the people of NEFA*. Shilong,: Research Dept., Adviser's Secretariat.

Steriade, D. (1989). Affricates and Stops. Presented at the Features Conference, Cambridge, MA: MIT.

Stetson, R.H. (1951). *Motor phonetics: A Study of Speech Movement in Action*, 2nd ed. Amsterdam: North-Holland Publishing Co.

Survey of India. (2002). India-Political. Retrieved April 23, 2015, from <http://www.surveyofindia.gov.in/files/India_potitical.pdf>

——. (2013). Arunachal Pradesh. Retrieved April 23, 2015, from <http://www.surveyofindia.gov.in/files/Arunachal_Pradesh_1.pdf>

Teshigawara, M. (2002). Vowel devoicing in Tokyo Japanese. Morrison G. S. & Zsoldos L. (eds) *Proceedings of the North West Linguistics Conference*, pp. 49–65. Simon Fraser University Linguistics Graduate Student Association: Burnaby, BC, Canada.

Tsuchida, A. (1997). *Phonetics and Phonetics of Vowel Devoicing* (PhD dissertation). Cornell University.

Tzakosta, M., & Jeroen Vis. (2009). Asymmetries of Consonant Sequences in Perception and Production: Affricates vs. /s/ Clussers. Presented at the 18 th International Symposium of Theoretical and Applied Linguistics, Thessaloniki: University of Thessaloniki.

Varden, J. K. (1998). *On High Vowel Devoicing in Standard Modern Japanese: Implications for Current Phonological Theory* (PhD dissertation). University of Washington.

Vennemann, T. (1972). On the Theory of Syllabic Phonology. *linguistische Berichte*, 18: 1–18.

——. (1988). *Preference laws for syllable structure and the explanation of sound change with special reference to German, Germanic, Italian, and Latin*. Berlin: Mouton de Gruyter.

——. (2012). Structural complexity of consonant clusters: a phonologist's view. Hoole P. et al. (ed.) *Consonant Clusters and Structural Complexity*, Interface Explorations, pp. 9–32. De Gruyter Mouton: Berlin.

Weijer, J. M. van de. (1994). *Segmental Structure and Complex Segments*. Leiden: Holland Institute of Generative Linguistics.

Wiese, R. (1996). *The Phonology of German*. Oxford: Clarendon Press.

Yoshida, N., & Sagisaka, Y. (1990). *Boin museika no yoin kenkyu (Study on factors relating to vowel devoicing)* (ATR Technical Report No. TR-I-0159).