The Mora and the Syllable in KiMvita (Mombasa Swahili) and Japanese

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Abstract

This thesis deals mainly with aspects of the phonology of KiMvita, the Swahili dialect spoken in Mombasa, and has special reference to moraic nasals. The KiMvita analysis is then compared to that of Standard Japanese. The framework of moraic theory that is employed is based on Hyman's (1985) "Weight Theory". The theories of Feature Geometry (FG) and Lexical Phonology (LP) are also employed in the analysis.

Nasal+Consonant (N+C) sequences occur in two ways in KiMvita: (i) a sequence of a moraic nasal and a consonant; (ii) a prenasalized obstruent. The analysis of the varying expressions of nasality, either as a moraic segment or as an element of a complex segment shows considerable dependence upon the morphology concerned.

In addition to N+C sequences, the analysis of Consonant+Glide (C+G) sequences turns out to be great relevance; these two different types of composite segment differ in underlying representation as well as in surface syllabification. Here too LP enables us to distinguish two distinct surface forms (light diphthongs and complex consonants) in terms of lexical vs. post-lexical levels.

Syllable construction in this study crucially requires both an onset and a nucleus. Processes of syllabification will be discussed based on this theoretical requirement together with the following two assumptions: (i) strictly left-to-right syllabification; (ii) priority of the Onset Creation Rule.

This study proposes that the accent bearer both in KiMvita and Japanese is not the syllable, which is generally claimed in the literature, but the mora - though this may be associated with a syllable node.

Moraic nasals are generally associated with the second mora of a bimoraic syllable word-internally in both KiMvita and Japanese. However, there is one significant difference in the status of the second mora in these two languages: it may bear accent in KiMvita, while it may not in Japanese. As far as these two languages are concerned, the phonetic evidence suggests that the actual segment duration could explain why such a difference occurs.

Contents

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Abbreviations

A	adjective
ABC	Accent Bearer Constraint
C	consonant
C̩	moraic consonant
[C]	[consonantal] (major class feature)
CCF	Complex Consonant Formation
cont	continuant
cor	coronal
Cs	causative
dor	dorsal
EP	egressive pulmonic airstream mechanism
fn	footnote
G	glide
GF	Glide Formation
H	high tone
IG	ingressive glottalic airstream mechanism
L	(1) liquid
	(2) low tone
lab	labial
LD	light diphthong
LDF	Light Diphthong Formation
LSC	Least Syllable Condition
M	morpheme
MCC	Moraic Consonant Constraint
MCR	Margin Creation Rule
MWSC	Minimal Word Size Constraint
N	(1) nasal
	(2) moraic nasal in Japanese
	(3) archiphoneme of nasal prefix of Cl. 9/10
N̩	moraic nasal in KiMvita/KiSwahili
N	noun
(N. 1)	noun class number
nas	nasal

OAR	Onset Adjunction Rule
obj	object
obl	oblique
OCR	Onset Creation Rule
PC	phonetic component
pl	plural
Ps	passive
RN	root node
[S]	[sonorant] (major class feature)
SA	secondary articulation
sb	subject
sg	singular
SMC	Second Mora Constraint
SPE	Sound Pattern of English
UR	underlying representation
V	vowel
v	verb
WU	weight unit
1st	1st person
2nd	2nd person
3rd	3rd person
σ	syllable
μ	mora
μ'	unsyllabified mora
ω	phonological word
.	internal syllable boundary
;	internal mora boundary
→/←	'becomes' synchronically
</>	(1) 'becomes' diachronically
	(2) bigger than
*	(1) ill formed
	(2) historical development
+/-	morpheme boundary
/ /	phonemic transcription
[ ]	(1) phonetic transcription
	(2) feature

Introduction

This thesis mainly concerns the phonology of KiMvita; one of the Northern Swahili dialects spoken in Mombasa in Kenya, which is now facing extinction. However, originally the starting point of this study of KiMvita was the comparison of moraic nasals between KiMvita and Standard Japanese (hereafter Japanese). Hence, the moraic nasal in Japanese is also a concern of this study. Although the initial intention of the research was the moraic nasals found in the two languages, research on moraic nasals in KiMvita involved two types of sequence, Nasal+Consonant (hereafter N+C) and Consonant+Glide (henceforth C+G), and certain other aspects of its phonology. As a consequence, the main focus has become the phonology of KiMvita. This development was supported by the following additional reasons.

Firstly, as mentioned above, KiMvita is regarded as an endangered language. Since a standard Swahili language was established and more people came from inland or other areas to settle down in Mombasa, the number of KiMvita speakers has been fallen. Consequently, only a limited number of people, who are generally of the older generation, speak KiMvita at present. My informant, Sheikh Yahya Ali Omar (hereafter Sh. Yahya) now in his mid-late seventies, is one of the last generation of speakers. He has lived in London for more than ten years. It was a great piece of luck to have had the chance to meet him in London. One might feel concern about a loss of accuracy of his mother tongue because of the long absence from his mother country ('Swahili land' in Sh. Yahya's terms). I am not too concerned about this, for even if he had lived in Mombasa throughout his life, his mother tongue might still have been influenced by Standard Swahili to some extent. However, this does not mean that all KiMvita speakers in Mombasa are necessarily influenced by Standard Swahili. On the other hand, living abroad for such a long period might have enabled him to retain his KiMvita without any influence. In addition, Sh. Yahya's deep enthusiasm for his mother tongue, KiMvita, has manifested itself in his cooperation with linguists in this country in research on his language. His considerable insight into KiMvita indicates that he is not simply a naïve native speaker. From these points, I believe that the source provided by Sh. Yahya is unconditionally reliable. Secondly, several works have appeared in the literature on Swahili phonology so far; most of these are purely descriptive approaches (see Tucker and Ashton 1942, Whitely 1955, Polomé 1967, and Nurse and Hinnebusch 1993, among others). Although at least one theoretical analysis is found in Bakari's (1985) study, it is based on an early generative phonology model. New research within a more recent phonological theory is surely required. From these two reasons, as well as on account of the extended intention of research, it is strongly felt that conducting research on KiMvita within a more modern theoretical framework is important and worthwhile.

Theoretical points

This thesis investigates issues that KiMvita and Japanese raise within the framework of the moraic theory originating in Hyman's (1985) 'Weight Theory'. In particular we will see how the two phonological constituents, the mora and the syllable, interact in the phonologies of the two languages. The theories of Lexical Phonology (LP) and Feature Geometry (FG) are also employed to analyze certain issues.

Although insightful ideas are abundant in Hyman's theory, his Onset Creation Rule (OCR) and Glide Formation (GF) together with the representation of glides seem to require revision. Firstly, the original OCR does not deal with a sequence of a high vocoid ('glide') and a vowel which creates a syllable. However, in some languages such as KiMvita, Japanese, etc., such a sequence, in fact, constructs a syllable in certain environments. This urges us to revise Hyman's OCR; this will take place in 4.2.1. The second point concerns 'glides' in two ways: the GF process and the representation of glides themselves. As we will see in Hyman's GF, the most sonorous Weight Unit (see 1.2.4) is lost, which is an idea which seems to be crucially flawed, and moreover, it captures only the case in which a high vocoid becomes a glide to the preceding consonant, hence creating a complex consonant. However, a language like KiMvita contains two types of high vocoid: (i) one which becomes a component of a complex consonant; (ii) one which becomes a component of a nucleus, i.e., a light diphthong. This fact also requires a revision of GF so that two types of high vocoid can be differentiated. Discussion about these matters will take place in 2.4.3.2. Regarding the representation of glides, Hyman exploits a [±cons] feature to distinguish a glide consonant from a high vowel. However, such use of a [-cons] feature for a high vowel in surface representations is redundant. This flaw will be dealt with by employing a proposal of Clements within the theory of FG in 2.4.4.

The ideas of LP are employed to analyze occurrences of certain morphemes, e.g., vowel-initial noun stems with two sets of prefixes, passive/causative verb forms, etc. in the lexicon based on the phonological derivation and the nature of underived or derived items in KiMvita. Similarly in Japanese, a vowel-initial morpheme found internally in a compound in general, including a Sino-Japanese compound, and another vowel-initial morpheme are differentiated by the two components of LP; namely, the lexical phonology and the post-lexical phonology.

With regard to syllabification, following Hyman's treatment of unsyllabified vowel sequences in Gokana, I will propose that construction of syllable requires both an onset and a nucleus, which is expressed in the Least Syllable Condition (LSC), as will be discussed in 2.4.1. In connection with the LSC, syllabification of uninterrupted vowel sequences in three languages, Saho (Hayward 1997), KiMvita and Japanese will be discussed. Syllabification will be discussed under two assumptions. One concerns a rule which operates prior to any other rules or formations, and I assume that the OCR, advocated by Hyman (1985), is the first rule to apply. The other involves the directionality of syllabification; strictly left-to right syllabification is considered in this study.

KiMvita

Based on my informant's pronunciation, a revision of the inventory of the consonant phonemes of this language is considered, focusing in particular on sequences involving consonants followed by high vocoids. Certain previously unrecognized phonemes will be considered. Moreover, the issue of whether or not prenasalized obstruents constitute phonemes in the deep phonology will be treated (Chapters 3 and 4).

Park's (1995, 1997) claim that (Standard) Swahili requires only a monomoraic syllable type will be refuted by two pieces of evidence: (i) the distribution of voiced stops; (ii) stressed segment lengthening (Ch. 3).

The usual claim for KiSwahili that the stress bearer is the syllable is revised and this study will propose that the mora is the stress bearer. In connection with this revision concerning the stress bearer, the stress assignment rule will also be revised (Ch. 3).

Like some other Bantu languages, KiMvita, KiSwahili in general, contains two types of N+C sequence: (i) a prenasalized obstruent; (ii) a moraic nasal followed by a consonant. Following Herbert (1986), a prenasalized obstruent is regarded as a sequence underlyingly, and such treatment fits well with Hyman's 'Weight Theory'. The two types of nasal are distinguished by their feature organization and as a consequence, distinct syllabifications are required (Ch. 4).

Two types of behaviour in consonant + high vocoid (glide) sequences are recognized in KiMvita as mentioned above: a glide which is a component of a complex consonantal segment and a glide which is a component of a light diphthong. They are derived by two distinct formations (Ch. 4).

Japanese

The claim that the accent bearer in Japanese is the syllable, which has been advanced by many phonologists, needs to be revised from two points of view. The phonetic realization of pitch accent can be explained more straightforwardly if the accent bearer is the mora. Contrary to the 'Pre-*no* Deaccenting Rule' which has been discussed in the literature, a better generalization can be made by reference to the mora, rather than the syllable.

Recognition of a trimoraic syllable seems to be inevitable for certain sequences, i.e., those found in compounds and past tense verb forms. Since certain compounds, such as *roNdoNkko* 'Londoner', fail to satisfy the Accent Bearer Constraint (ABC), which says that the second mora may not bear accent, a revised ABC is needed so that a trimoraic syllable may be employed for such a sequence without violation of the constraint.

Three types of segment can be found in the second mora of a bimoraic syllable; namely, nasals, certain obstruents and vowels. A condition on the second mora will be proposed, and it will be believed to cover a wider range of segments in a more straightforward manner than the 'Coda Condition' advanced by Itô (1986).

The characteristic of moraic nasals and moraic obstruents is their dependence on the preceding vowel. Such a characteristic is interpreted in terms of their incapability to construct an independent syllable. This inability will be expressed in the Moraic Consonant Constraint.

The syllabification of vowel-initial morphemes is discussed in accordance with the notion of an inherent bare root node, following an idea advanced by Hayward (1997), and glottal stop epenthesis.

The syllabification of a sequence of CVNV (where V and N refer to vowel and moraic nasal respectively) raises a question as to whether or not resyllabification occurs so that the N becomes an onset to the second V. I assume that an inherent bare root node prevents the N from losing its moraicity and subsequently undergoing resyllabification.

Other issues discussed in KiMvita and Japanese

Both KiMvita and Japanese could be regarded as containing bisegmental long vowels; in each language, a language game demonstrates such a claim.

The status of the (moraic) nasal as being associated with the second mora of a bimoraic syllable in the two languages clearly shows up in terms of the Accent Bearer Constraint; i.e. whether the moraic nasal may bear accent or not. While in KiMvita it may bear accent, it may not in Japanese. Such a difference might be demonstrated by phonetic quantification, i.e., by duration measurement, and these data are presented in the Appendices.

Chapter 1
The Mora

1. 0 Introduction

In this chapter, we look at how the concept of the mora has been utilized in phonology. The first use of the concept of the mora as a time-unit for metrical purposes was during the Greek period. However, the term was not 'mora' in that period.[1] According to Allen (1968: 100), the term 'mora' with its modern meaning was first employed by Gottfried Hermann (1772-1848), a German scholar.[2] Yoshiba (1983: 25) cites Allen's statement and adds the following information; the term 'mora' seems first to have appeared in English linguistic writings in Donaldson's (1848) Greek Grammar. Since then, the term 'mora' has achieved general recognition in phonology. Within the Prague School, Trubetzkoy (1969 [1939]) utilized the concept of the mora as a unit to measure a syllable nucleus. However, under the influence of the SPE-type phonology inaugurated by Chomsky and Halle (1968), the 'mora' lost any formal status it had had. Then, in the 1970's it was revived in metrical phonology as advocated by Liberman and Prince (1977). Another type of use of the concept of the mora is seen in McCawley's (1978) typological taxonomy. In agreement with McCawley's classification of (Standard) Japanese as a 'mora-counting syllable language', the concept of the mora has been utilized by many native and non-native Japanese linguists.

In section 1.1, the concept of the mora that was utilized in the Greek period will be sketched out. The relationship between mora and syllable from various viewpoints will be discussed in section 1.2. In the later part of that section, two moraic theories, as advocated by Hyman (1985) and Hayes (1989), will be outlined. Following this, in section 1.3, I shall discuss which theory will be adopted in this study.

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[1] The Greek word 'mora' with its modern meaning was not recognized at that period but later.

[2] Allen does not cite his work. It might be assumed that one of the following works might contain this term: Hermann, G. (1801) *De Emendenda Ratione Graecae Grammaticae*; (1815) *De Metrorum Quorundam mensura Rhythmica*; or (1816) *Elementa Doctrine Metricae*.

1. 1 The Antiquity of the Concept

The concept of the mora as a time-unit in speech was already recognized in Classical Greek and Sanskrit, being known as: 'chronos protos' (primary time) and 'mātrā' respectively. These terms were used to describe vowel length, and also to characterize syllable quantity.

According to Yoshiba (1983), Goodell (1901: 8-9) states that in the classical period, there were two schools: the Metrici and the Rhythmici, headed by Aristoxenos, and that the Metrici applied one time-unit, one chronos protos, to the length of a short vowel, while two chronoi protoi were applied to a long vowel (cf. Allen 1973).[3, 4] This time-unit also described the syllable quantity: a short syllable required one chronos protos, whereas a long syllable required two chronoi protoi. Consequently the ratio of short to long syllables is always 1: 2. On the other hand, the Rhythmici did not make a clear distinction between long and short syllables, stating instead that various differences were recognized within long syllables and within short syllables, i.e., that there were differences of degree. However, some grammarians among the Rhythmici claimed that the length of a single consonant was equivalent to half the length of a short vowel.[5] This claim concerning the length of consonants, as well as that of vowels, implied that syllable quantity could be calculated by counting the length of every segment in a syllable. However, this idea did not seem to be successful. This will be discussed in a later section.

The views held by the Metrici and the Rhythmici regarding the length of constituents and syllable quantity are summarized in (1) and (2). (1c) was claimed by the Rhythmici, (1a, b) were claimed by both; while (2) was claimed by the Metrici.

(1) Length of segment
   a. A short vowel is equivalent to 1 chronos protos
   b. A long vowel is equivalent to 2 chronoi protoi
   c. A consonant is equivalent to 1/2 chronos protos

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[3] Two chronoi protoi were also applied to a diphthong, which can be seen in Allen's (1973: 49) statement: "In the classical languages, including Sanskrit, diphthongs are for the most part phonologically and metrically equivalent to long vowels; so that whatever is said about the latter may generally also be taken to apply to the former".

[4] According to Goodell, in the Alexandrian age, this was already a traditional, common notion which went back at least to the time of Plato (Yoshiba 1983: 27).

[5] Although Goodell states that the length of two consonants or a geminate is equivalent to one short vowel, Allen does not mention it.

(2) Syllable quantity

a. A short syllable requires 1 chronos protos

b. A long syllable requires 2 chronoi protoi

Similar criteria to those given in (1) and (2) were also found in the Sanskrit tradition (Allen 1953). In Sanskrit, the term 'mātrā' was used for a time-unit, and with regard to consonants, either 1/2 mātrā or 1 mātrā was assigned to the length of a consonant, depending on the linguistic school concerned.

It should be noted that the use of the terms 'long' and 'short' leads to some confusion, since they are exploited for describing both the length of vowels and syllable quantity. The following statement by Whitney concerning these terms makes a clear distinction.

> The distinction in terms between the difference of long and short in vowel-sound and that of heavy and light in syllable-construction is valuable and should be observed.
>
> (Whitney 1889: 28)

As in the Taittirīya-Prāisākhya (TP) (Allen 1953: 85), the terms 'heavy' and 'light' ('guru' and 'laghu' respectively in the original text) are used for referring to 'syllable quantity (=weight in this study)' throughout the rest of this thesis. One further point concerning terminology should be mentioned. Since the terminology for the time-unit, chronos protos or mātrā, seems to be equivalent to 'mora' in current theories, the latter term will be used consistently.

1. 2 The Relationship between Mora and Syllable

Both mora and syllable have existed as necessary concepts of constituents in phonology for a long time, and will doubtless continue to do so. As is well-known, morae and/or syllables play crucial roles in various aspects of phonology. While treatments of them vary between theories, no objection seems to have been raised against the basic claim that a heavy (long) syllable contains two morae (weight/time-units), while a light (short) syllable contains one. According to Yoshiba (1983), hypotheses about the relation between morae and syllables can be divided into two types: the Single Unit Hypothesis, which Yoshiba himself holds, and the Subunit Hypothesis. The latter is further divided into two categories: the (Simple) Subunit Hypothesis and the Dual Unit

Hypothesis. Trubetzkoy's view belongs to the former, whereas the latter is supported by McCawley. In this section, three treatments of the mora and syllable are considered; namely, those of Trubetzkoy (1969 [1939]), McCawley (1978), and the Japanese linguists (Shibata 1980b, Kubozono 1987, 1995, Yoshiba 1983).

1. 2. 1 The Prague School

The treatment of morae and syllables by the Prague School is an instance of the Simple Subunit Hypothesis in Yoshiba's terms. In it the types of relationship holding between morae and syllables are regarded as typologically contrastive for classifying languages. Trubetzkoy treats a mora as the smallest unit with which to measure a syllabic nucleus. He (1969[1939]: 170) claims that prosodic properties belong to the syllables, but not to the vowels per se, even though only a specific portion of the syllable, the syllabic nucleus, may actually carry prosodic properties in accordance with the grammar of the language in question. A possible syllabic nucleus consists either of a vowel, a polyphonematic vowel combination, a consonant, or a polyphonematic combination of vowel and consonant. These possibilities imply that prosodic properties are not always correlated with the occurrence of vocalic properties. Consonants entitled to carry the prosodic properties are usually the so-called sonorants, i.e., the nasals and the liquids.

Trubetzkoy (1969 [1939]) states that a possible syllabic nucleus is either monophonematic or polyphonematic, which means that it is a single phoneme or a combination of phonemes respectively. In any case a syllable can hold only one nucleus. There may then be a question as to the treatment of the so-called long syllable nuclei. Trubetzkoy (op. cit.), who utilizes the concept of the mora to discuss so-called long syllable nuclei, sets up the following five criteria in order to decide whether a long syllable nucleus is really one or two morae.

(i) The criterion of internal morpheme boundaries
When a morpheme boundary appears within the long syllable nucleus, as is found in Finnish, the long vowel must be seen as consisting of two homophonous short vowels. In the so-called partitive forms, a morpheme *a* or *ä* is realized at the end of a word, for example, *talo* 'house' vs. *taloa* In the case of a word ending in *a* or *ä*, the final vowel of the word is lengthened: e.g., *kukka* 'flower' and *leipä* 'bread' become *kukkaa* and *leipää* respectively (examples from Trubetzkoy (1969[1939]: 173)). Hence,

the long vowels must be considered the sum of two homophonous short vowels.

(ii) The criterion of integrity as shown by construction processes etc.
In Slovak (both standard and dialectal), by the law of rhythmical shortening, a long syllable nucleus is shortened when preceded in the syllable to its left by a long vowel, a long liquid, or a rising diphthong such as *ie, uo, ia,* and *iu.* These diphthongs under the same conditions as a long syllable nucleus as described above are also subject to shortening, i.e., they are replaced by a monophthongal short vowel. In standard Slovak and the central dialects, adjectival endings are long as seen in a word like *pekný* 'nice' (where the acute accent represents a long vowel).[6] However, a word like *krásny* 'beautiful' shows the law of rhythmical shortening, since an adjectival ending in *krásny* is preceded by a long syllable nucleus. Consequently *y* of *krásny* is realized as a short vowel (examples are from Short 1993: 538). It is also said that the long syllable nucleus is considered as a monosyllabic combination of two like syllable nuclei.

(iii) The criterion of accentuation in the long syllable nucleus
In considering the relationship between accentuation and the long syllable nuclei, the long nucleus may be treated as one long unit corresponding to two short units. In other words, a long syllable nucleus is equated with two short syllable nuclei, as is found in Classical Latin. The accent falls on the penultimate mora by counting morae from the end of the penultimate syllable; the accent falls on the penultimate mora if the penultimate syllable is heavy, or on the ante-penultimate syllable (regardless of quantity) if the penultimate syllable is light (cf. Allen 1965). For example, in a word like *con-féc-tus,* the accent falls on the penultimate syllable, since this is a heavy syllable containing the penultimate mora before the last syllable, in a word like *con-fí-ci-o,* on the other hand, the antepenultimate syllable is assigned the accent, since the penultimate syllable is light (examples from Allen 1965: 83).

[6] In the orthography, *y* and *ý* represent /i/ and /i:/, though the letters *i* and *í* are also used to represent /i/ and /i:/. This is for historical, etymological reasons (see Short, 1993).

(iv) The criterion of pitch contour in the long syllable nucleus

A phonemic distinction based on accent location is realized in a long syllable nucleus, i.e., a long syllable nucleus is considered as biphonematic. This is applicable in Lithuanian and Japanese. In these languages, the first half of the long syllable nucleus is treated differently from the last half in terms of pitch pattern. This phenomenon is also realized in a poly-phonematic nucleus, such as a diphthong or a combination of a vowel and a sonorant. In Japanese, either low or high pitch (abbreviated to L or H) is allotted to either the first or the last half of (especially) a word-initial long syllable nucleus.[7] When a word-initial long syllable nucleus bears accent, the high pitch is allotted to the first half of such a nucleus, while the low pitch is allotted to the last half of it; e.g., *suuri* (HL) 'mathematical principle', *kaN* (HL) 'tin', and *kai* (HL) 'shellfish'. On the other hand, when accent is not borne by the word-initial long syllable nucleus, the mirror image of this pitch assignment is found in words such as *suugaku* (LH) 'mathematics', *kaN* (LH) 'intuition', and *kai* (LH) 'rewarding'; the low pitch is allotted to the first half of the long syllable nucleus and the high pitch to the remainder.[8]

(v) The criterion of the so-called 'stød'

Danish and Latvian show clear proof of the biphonematic nature of the long syllable nucleus: the so-called 'stød' appears only in a long syllable nucleus; it cannot intrude in a short syllable nucleus. Consequently, what we find is a long syllable nucleus with 'stød', a long syllable nucleus without 'stød', or a short syllable nucleus on its own. The so-called 'stød' can also be recognized in long syllable nuclei such as diphthongs and combinations of vowels and sonorants. For example, a word *dej* 'dough' occurs with stød, while a word *dig* 'you' (obl. form) occurs without stød (examples from Staun 1987: 170).

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[7] In some Japanese dialects, this kind of pitch assignment is not found, as it is for standard Japanese and some other Japanese dialects. Regarding a word-internal long syllable nucleus, the LL or the HH pattern is seen if accent is not assigned to such a nucleus, for example *keekootoo* 'fluorescent light (lamp)' exhibits the LHHHHH pattern (see 1.2.3.2 and 5.2 for the accent rules in Japanese).

[8] In the Japanese examples, N refers to moraic nasal throughout this thesis.

To sum up the criteria given above, I cite Trubetzkoy:

> The interpretation of long syllable nuclei as geminated, or in terms of multimember constituency in general, may be regarded as an "arithmetic conception of quantity".
>
> (Trubetzkoy 1969 [1939]: 177)

Based on the criteria and the interpretation of a long syllable nucleus, Trubetzkoy classified languages as either mora-counting or syllable-counting. In the former, the small phonological unit, the mora, does not always coincide with a syllable boundary. In the latter, by contrast, the phonological unit always coincides with the syllable. A long syllable nucleus, which also exists in the syllable-counting languages, is not counted as two short syllable nuclei, but as an inseparable unit.

1. 2. 2 McCawley's Taxonomy

Trubetzkoy's typology is revised by McCawley (1978), who classifies languages into four groups. Two distinct units, the mora and the syllable, are employed for computation of the accent location, and also for functioning as an accent bearer. Based on these criteria, two oppositions are suggested: 'mora-counting' vs. 'syllable-counting' languages and 'mora language' vs. 'syllable language'. Consequently, combinations of these four terms yield mora-counting mora languages, syllable-counting syllable languages, mora-counting syllable languages and syllable counting mora languages. This typology is analysed by Yoshiba (1983) as falling under the Subunit Hypothesis, more precisely, the Dual Unit Hypothesis, since unlike Trubetzkoy, McCawley exploits a two-fold classification. McCawley's typology is shown together with illustrative languages in the following table:

(3)

	Syllable language	Mora language
Syllable counting	Polish	Beja
Mora counting	Standard Japanese	Lithuanian
	Latin	

(McCawley 1978: 129)

Standard Japanese is widely considered to be a mora-counting syllable language (though not by Yoshiba; see below), that is, phonological distance is measured by the unit called the mora, while the unit bearing accent is the syllable.[9] In Japanese poetry, the metric patterns are counted using the mora; 5 - 7 - 5 for *haiku* and 5 - 7 - 5 - 7 - 7 for *tanka/waka*. For example, *Cha;no;ha;na;ni -ka;ku;re;N;bo;su;ru - su;zu;me;ka;na* (where ; indicates an internal mora boundary) 'Among the tea flowers, the little sparrows play hide-and-seek' by a haiku poet, Issa Kobayashi: the lines consist respectively of five, seven, and five morae.[10] With regard to the accentuation, it is generally said that for loanwords containing more than two syllables, the pitch accent falls on the syllable dominating the third mora from the last, or the fourth mora if the accented syllable is heavy: for example, *t⃰enisu* 'tennis' and *kare⃰Ndaa* 'calendar' (note: an asterisk, *, indicates the pitch accent throughout this thesis).[11] This rule is also seen in compounds in which the second morpheme consists of more than two morae and regardless of its own accentedness: *natu* 'summer' + *yasumi⃰* 'break, holiday' → *natuya⃰sumi* 'summer holiday' and *o⃰Ngaku* 'music' + daigaku 'university' → *oNgakuda⃰igaku* 'music college'.

Lithuanian, classified as a mora-counting mora language, contains both light and heavy syllables. Only the rising accent is assigned to the light (monomoraic) syllables, while either the rising or the falling accent is allowed in the heavy (bimoraic) syllables. A rising accented stem-final syllable, and an accented light syllable, as in (4b, c), are subject to an accent attraction process by Saussure's Law, which can be stated as follows: "Accent is attracted from a stem-final mora onto certain affixes" (McCawley 1978: 130). The following examples (Dudas and O'Bryan 1972: 88-89) are cited by McCawley (*ibid.*). In the left-hand column in (4), the standard orthographic accent marks, ´ , ˜, and ` indicate falling accent, rising accent, and accent on a short syllable respectively. In the right-hand column in (4), an asterisk, *, is utilized to indicate accent; * on the first mora of a heavy syllable as in (4a) is realized as a HL tonal sequence, * on the second mora of a heavy syllable as in (4b) is realized as a LH tonal sequence, and finally * on a light syllable is realized as H tone.

(4)

a.	áug-u	'I increase'	a⃰ug-u
b.	vel̃k-u → velk-ù	'I pull'	vel⃰k-u → velk-u⃰
c.	rìš-u → rìš-ù	'I tie'	ri⃰š-u → riš-u⃰

---

[9] I shall discuss the accent bearer in 5.2.2.

[10] The translation was made by Sam Hamill (in Kobayashi Issa 1997).

[11] Not all loanwords consisting of more than two morae words undergo this rule (see footnote (hereafter fn) 21 in this chapter).

Polish, a syllable-counting syllable language, has no distinction between light and heavy syllables. The accent always falls on the penultimate syllable, for example, *szá-fa* 'cupboard' vs. *szát-nia* 'cloakroom'.[12] As a result, McCawley (1978: 130) states that it is not clear that a distinction between mora and syllable need be drawn for Polish.

In Beja, spoken in north-eastern Sudan and classified as a syllable-counting mora language, two accent patterns are recognized in the heavy syllable, i.e., a syllable containing a long vowel: level high and falling pitch. On the other hand, only one type is found in the light syllable, i.e., a syllable that contains a short vowel. The mechanism of accentuation in Beja is two-way: 'final accent' and 'penultimate accent' as stated by Hudson (1973).[13] These terms are understood to be as follows: 'final accent' means that the accent is on the final mora of the word, 'penultimate accent' means that for words containing more than one syllable, the accent bearer is the final mora of the penultimate syllable, while with words containing only one (heavy) syllable, it is the first (penultimate) mora which bears the accent, (McCawley 1978: 130). As can be seen in (5), the two types of accent assignment are found in pairs of singular and plural forms; i.e., that if a penultimate accent is found in a singular form, a plural counterpart form acquires a final accent and vice versa. Examples from McCawley are illustrated in (5), (where * indicates the accent, and the left two examples are mora-counting words while the right two are syllable-counting examples).

(5)

	'camel'	'mother'	'book'	'bride'
Singular	ka*am	dee*t	ki*taab	doobaa*t
Plural	ka*m	de*et	kita*b	doo*baat

(McCawley 1978: 130)

However, the categorization of Beja as a syllable-counting mora language is rather controversial among phonologists. Hudson (1973) discusses whether or not Beja is a syllable-counting mora language according to his observations on the surface behaviour of its phonology. He states that based on a surface study of the language, Beja seems to fit all four of the categories which McCawley advocates. Hudson characterizes the accentuation phenomena of Beja in the following way: Beja is counted as a syllable-counting mora language

[12] My thanks to Anna Debska, who provided these examples.

[13] See Hudson (1973) for a full discussion.

with respect to surface phonology, but a mora-counting mora language with respect to deep phonology. However, Yoshiba (1983) seems not to be convinced of the existence of the syllable-counting mora language type. Since the accent bearer, the mora, must be found in an appropriate mora by counting in morae within the syllable, Yoshiba suggests that the appropriate term with which to classify Beja is as a mora- and syllable-counting mora language. Consequently, he proposes that there is no need for such a typology and that only the mora plays a role.

1. 2. 3 Japanese Linguists on the Mora

There is no doubt among linguists of Japanese that the smallest phonological unit in Japanese is the mora. As we have already seen above, in Japanese poetry, the metrical patterns are counted using the mora. The concept of the mora is also employed in accounting for speech errors and in speech perception (see Kubozono 1989 and 1993 respectively) or a language game (see Katada 1990). However, in some Japanese dialects, a mora coincides with a syllable, and consequently two types of dialect are distinguished by utilizing the concept of the mora. It is also widely accepted that the concept of the mora plays a crucial role in accent assignment in Japanese. In this section, the way in which the two types of Japanese dialect are classified by Shibata (1980b) is sketched out first. Then a general view of the accent system in underived words and Kubozono's (1987) Compound Accent Rule (CAR) are considered. These are followed by an account of Yoshiba's theory.

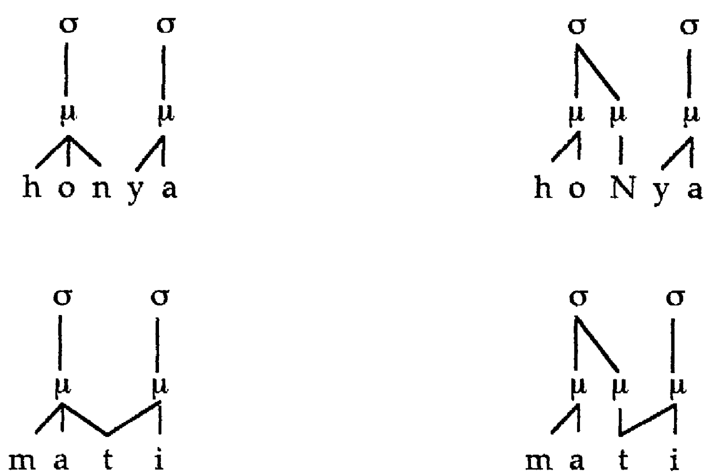
1. 2. 3. 1 Shibata's classification of dialects

The concept of the mora is exploited for the purpose of categorizing Japanese dialects. Shibata (1980b) classifies dialects into two types: the syllabeme dialects, which are found in the northern part of Japan (Tohoku region including Hakodate in Hokkaido), and the southern part of Japan (Kyushu region especially Miyazaki Pref. and Kagoshima Pref.); and the mora dialects, which occur in all other dialects, including the Tokyo dialect (in a broad sense, equivalent to (Standard) Japanese).[14] Shibata (op. cit.: 222) defines these two types of dialect as follows: the former are dialects in which a mora coincides with a syllable while the latter are dialects in which the mora is the

[14] Haraguchi (1977) calls these dialects a syllable-type dialect and a mora-type dialect.

smallest unit. For example, a word such as *hoNya* 'book shop' is realized as *hon;ya* and *ho;N;ya* (where ; indicates a mora boundary) in the syllabeme dialects and in the mora dialects respectively. The same distinction is found in a word containing a geminate consonant: *matti* 'a match' which is realized as *mat;ti* and *ma;t;ti* in the two dialect types. The structures for these words are diagrammed in (6). Regarding syllable structure, this will be discussed fully in chapter 2; here I simply note the syllable structure: melody segments are associated with a syllable node via a mediating phonological unit, the mora.

(6) a. Syllabeme dialect b. Mora dialect



With respect to long vowels and diphthongs in the syllabeme dialects, it seems that they behave the same as the post-vocalic consonants such as (the so-called moraic) nasals and the earlier component of geminate consonants.[15] Shibata (op. cit.: 223) states that in the syllabeme dialects, long vowels and diphthongs as well as post-vocalic consonants seem to be shorter than their counterparts in the mora dialects in terms of length. In other words, long vowels and diphthongs are not treated as two timing units but one. This treatment of long vowels and diphthongs seems to have an effect on accent assignment.

[15] It should be noted here that the terms 'pre-/post-vocalic (segments)' could possibly be ambiguous. Therefore, they need to be specified when they are employed. In this thesis, the 'pre-vocalic (segments)' refer to those in the 'onset' position in a broad sense; as we will discuss the realization of high vocoids, i.e., 'glides', in 3.3.2.2, one type of phonetic manifestation of high vocoids appears to be as a component of a light diphthong, and thus such a segment is not really in an onset position, however, the term 'pre-vocalic' is also applied to such a segment in the discussion. On the other hand, the 'post-vocalic (segments)' refer to those in the 'coda' position. However, neither of the terms, 'onset' nor 'coda', has any formal status in the moraic theory this thesis employs. When these terms are utilized in the thesis, they should be understood simply as conveniences.

Haraguchi (1977) discusses the accent (or tone) system of the Kagoshima dialect, one of the syllabeme dialects. Some examples cited from Haraguchi (op. cit.: 195-6) are shown in (7), where L, H, *, and . indicate respectively low tone, high tone, (pitch) accent and a syllable boundary. A syllable boundary is understood to be an internal syllable boundary throughout this thesis.

(7)

a. Accented	b. Unaccented
h$\overset{*}{a}$.na (HL) ha.n$\overset{*}{a}$-ga (LHL)	ha.na (LH) ha.na-ga (LLH)
'nose'	'flower'
m$\overset{*}{e}$i.rei (HL) mei.r$\overset{*}{e}$i-ga (LHL)	hon.dai (LH) hon.dai-ga (LLH)
'order'	'payment for books'
Ky$\overset{*}{u}$u.syuu (HL) Kyuu.sy$\overset{*}{u}$u-ga (LHL)	koo.koo (LH) koo.koo-ga (LLH)
'Kyushu'	'filial piety'
k$\overset{*}{i}$n.sen (HL) kin.s$\overset{*}{e}$n-ga(LHL)	kan.tan (LH) kan.tan-ga (LLH)
'money'	'simplicity'
ka.z$\overset{*}{a}$t.ta (LHL)	a.rat.ta (LLH)
'decorated'	'washed'

(-ga; subject marker)

Haraguchi uses the term 'syllable' instead of 'mora' in his account of tonal association in the Kagoshima dialect. This is clear from the examples in (7): one tone is associated with a whole syllable unlike in (Standard) Japanese (or the mora dialects). Haraguchi (1977: 196) states, " ..., if the final syllable and the penultimate syllable consist of a diphthong, the star[16] is assigned on [sic] the first vowel of the penultimate syllable ... Exactly the parallel situations are observed ... where the syllable consists of a long vowel, ... where the syllable consists of a vowel and a syllabic nasal N (my capital)". It is clear to see from Haraguchi's statement that although we have syllables with complex rhymes or nuclei, the concept of 'heavy syllable' is not really motivated in the Kagoshima dialect, one of syllabeme dialects.

To conclude this subsection, within current phonological theory, it could be said that in the syllabeme dialects, a post-vocalic segment is not associated with its own mora and as a result all syllables behave as light syllables. Regarding long vowels and diphthongs, Shibata's statement and Haraguchi's discussion on the accent system above suggest that a syllable consisting of a long vowel or a diphthong behaves like a light syllable. In other words, it

[16] It refers to accent.

seems that true heavy syllables are not found in the syllabeme dialects, whereas both light and heavy syllables are found in the mora dialects as seen in (Standard) Japanese.

1. 2. 3. 2 Kubozono's accent rule

The concept of the mora has been utilized for discussing the accent assignment and tonal association in Japanese by many linguists (see Hattori 1980, Shibata 1980a, McCawley 1968, 1977, Haraguchi 1977, Higurashi 1983, Yoshiba 1983, Poser 1984, Kubozono 1987, 1995, and Vance 1987, among others). It is widely accepted among linguists in Japanese that the mora is a tone-bearing unit (TBU). In words consisting of up to four morae[17], accent is determined lexically, i.e., accent location is unpredictable. In addition, the tonal association described by most linguists is briefly as follows: (i) an accented TBU is associated with the H(igh) tone; (ii) the L(ow) tone is associated with a TBU preceded by an accented TBU; (iii) the first TBU is associated with the L tone unless it bears accent; (iv) the first TBU and the second TBU never link to the same tone, therefore two word-initial tones are always either LH or HL; (v) if there is no accented TBU, the surface tonal pattern will be LH_{n-1} (where n is the number of morae a word consists of). Three-mora words of Japanese are shown as examples below .

(8)

a. *inoti (HLL) 'life'
b. koko*ro (LHL) 'mind'
c. otoko* (LHH) 'man'
d. nezumi (LHH) 'rat/mouse'

(Kubozono, 1995: 27)

Regarding polymoraic nouns, compounds and loanwords, their accent location is not of an arbitrary nature like that recognized in words of less than five morae in the underived lexicon, rather it is determined by a rule. Note that the term 'polymoraic' is understood to be more than four morae. Kubozono (1987: 20) states, "Japanese exhibits a certain number of phonological processes which are better described as accentual changes than as tonal changes..." in a discussion on the Compound Accent Rule (CAR).[18] He states that the second

[17] In the literature, up to three-mora words are usually exemplified. Four-mora words do exist in the underived lexicon, although the number of these words is limited (see McCawley 1968, 1977).

[18] Here the term 'Compound' includes forms containing derivational formatives as well as compounds proper (see 5.2.3).

morpheme of a compound plays a key role in determining accent location. For example, if the second morpheme contains one or two morae, accent falls on the last mora of the first morpheme.[19] If the second morpheme is more than two morae, the antepenultimate mora of the word bears accent if a word is specified as [+accented].[20] In both cases, accents already assigned to morphemes are eliminated before accent is assigned to a compound. The second rule is also applicable to polymoraic nouns and loanwords.[21] Examples are shown in (9).

(9)

a. compounds

o*Ngaku (HLLL) + bu* (H) 'music' 'club'	→	oNgaku*bu (LHHHL) 'music club'
deNwa (LHH) + kyo*ku (HL) 'telephone' 'exchange'	→	deNwa*kyoku (LHHLL) 'telephone exchange'
natu* (LH) + maturi (LHH) 'summer' 'festival'	→	natuma*turi (LHHLL) 'summer festival'

b. polymoraic noun

hototo*gisu (LHHLL)
'the little cuckoo'

c. loanword

kurisu*masu (LHHLL)
'Christmas'

The examples (9a) and (9c) have undergone the following processes.

(10)

Input:	o*Ngaku + bu*	natu* + maturi
Delete lexical accent:	oNgaku + bu	natu + maturi
Accent on the last mora of the first morpheme:	oNgaku* + bu	----
Accent on the antepenultimate mora of a compound:	----	natu + ma*turi
Output:	oNgaku*bu (LHHHL)	natuma*turi (LHHLL)

[19] This is not always the case. It depends on the type of the second morpheme. See Kubozono (1995: 59) for further discussion.

[20] See Haraguchi (1991: 12).

[21] Some loanwords are unaccented, e.g., huirumu (LHHH) 'film'. A mora other than the antepenult bears accent in some loanwords, e.g., do*kutaa (HLLL) 'doctor'. See Kubozono (1995: 74-77) for some other exceptions.

However, in the case of an accent bearer being the second mora of a syllable, one more rule is needed. In the literature, it is claimed that accent is never borne by the second mora of a heavy syllable whatever type of segment it is associated with. Therefore we need the rule stated in (11).[22]

(11) If the accented mora is the second mora of a syllable, accent is shifted to its left.

Examples are given in (12); representation of two identical consonant corresponds to a geminate consonant and the leftmost consonant is regarded as moraic.

(12)

a.	hoosoo (LHHH) + b*u(H)	→	hoos*oobu (LHHLL)
	'broadcast' 'club'		'broadcasting club'
b.	yuubiN (LHHH) + ky*oku (HL)	→	yuub*iNkyoku (LHHLLL)
	'post' 'office'		'post office'
c.	*oNgaku (HLLL) + gakkoo (LHHH)	→	oNgakug*akkoo (LHHHHLLL)
	'music' 'school'		'music school'
	d*ai (HL) + zeNtee (LHHH)	→	daiz*eNtee (LHHLLL)
	'big' 'premise'		'major premise'
	d*ai (HL) + koodoo (LHHH)	→	daik*oodoo (LHHLLL)
	'large' 'hall'		'large hall'
	raseN (LHH) + kaidaN (LHHH)	→	raseNk*aidaN (LHHHLLL)
	'spiral' 'stairs'		'spiral staircase'
d.	der*akkusu (LHLLL)[23]		sy*aNpoo (HLLL)
	'deluxe'		'shampoo'
	t*iitaa (HLLL)		dez*ainaa (LHLLL)
	'cheetah'		'designer'

(Examples in (12d) are cited from Kubozono 1995: 20)

As can be seen in examples illustrated in (12), if a mora which is to bear accent as allotted by the rules stated above is the second mora of a syllable (e.g. in (12a) the last *o* of *hoosoo*, in (12b) *N* of *yuubiN* and so on), then accent is

[22] See McCawley (1968) and Kubozono (1987, 1995), among others.

[23] This example seems to be rather controversial as to whether or not a mora associated with a devoiced vowel and a geminate consonant are considered as a tone-bearing unit. However, this issue is not our concern here.

shifted one mora to its left. Thus, accent assignment processes involving accent shift will be as follows.

(13)

<table>
<tr><th>Input:</th><th>hoosoo + b$\overset{*}{u}$</th><th>d$\overset{*}{a}$i + zeNtee</th></tr>
<tr><td>Delete lexical accent:</td><td>hoosoo + bu</td><td>dai + zeNtee</td></tr>
<tr><td>Accent on the last mora of the first morpheme:</td><td>σ
| \
hooso$\overset{*}{o}$ + bu</td><td>-----</td></tr>
<tr><td>Accent on the antepenultimate mora of a compound:</td><td>-----</td><td>σ
| \
dai + ze$\overset{*}{N}$tee</td></tr>
<tr><td>Accent Shift:</td><td>σ
| \
hoos$\overset{*}{o}$o + bu</td><td>σ
| \
dai + z$\overset{*}{e}$Ntee</td></tr>
<tr><td>Output:</td><td>hoos$\overset{*}{o}$obu (LHHLL)</td><td>daiz$\overset{*}{e}$Ntee (LHHLLL)</td></tr>
</table>

In sum, the mora is an essential phonological entity for stating accent rules in Japanese. One of the characteristic constraints is that the second mora of a heavy syllable may not bear accent, hence we need an accent shift rule as stated in (11).[24]

1. 2. 3. 3 Yoshiba's theory

Current linguistic theories are aimed at universality, which is what Yoshiba also aims at. From this point of view, Yoshiba considers the mora to be a phonological constituent of universal and more fundamental occurrence than the syllable. Hence, Yoshiba (1983) claims that only the mora plays a significant role for metrical purposes. He utilizes only the mora, dispensing with the syllable in analysing the metrical phenomena appearing in any language. In other words, Yoshiba reanalyzes all the types of languages (treated as typologically different in terms of McCawley's classification) utilizing only the concept of the mora, and he states that no typological distinctions need to be considered.

The notion of the mora has been based on two different notions as we have seen above: (i) the idea of it as a unit of syllable weight; and (ii) the idea of a unit of length allotted to segments. They are summarized in (14) and (15) respectively.

[24] I shall discuss constraints on the accent bearer in 5.3.3.2.3.2.

(14) A mora as a unit of weight for a syllable

a. a light syllable consists of one mora
b. a heavy syllable consists of two morae

(15) A mora as a unit of length for every segment

a. a single consonant requires half the time of a short vowel
$C : V = 1/2 : 1$
b. a long vowel or diphthong requires two time-units of a short vowel
$V_1V_2 : V = 2 : 1$ ($V_1=V_2$, $V_1 \neq V_2$)

The notion of mora as expressed in (14) appears both in the Classical Greek period, especially with the Metrici (Goodell 1901: 8-9, Allen 1973: 57), and in the more recent metrical phonology (McCarthy 1979, Prince 1980). On the other hand, the Rhythmici grammarians held the notion of mora outlined in (15) (Allen 1973: 56); as did the Sanskrit grammarians (Allen 1953: 83-84; quotation below). Yoshiba also advocates the notion of mora given in (15), and he takes the notion of the mora as a unit of length for each segment into consideration for his theory. Before his theory is outlined, these two notions as they appeared in relation to the classical languages are considered further.

Among the Rhythmici and the Sanskrit grammarians, a short vowel required one mora while a long vowel required two morae; a half mora was required by a consonant. However, according to Allen (1953), there was some disagreement about the length of the consonant among the Sanskrit grammarians. The general prescription was that it was a half mora, though there was one school, the AP(Atharava-Prātiśākhya), who maintained that it was one mora. This conflict somehow disappears in the course of Allen's discussion. As he (1953: 84) states, " But the mātrā concept has no justification in connexion with consonants; certainly it might have been used in conjunction with the rules of syllable-division for purposes of stating syllable-quantity, but in fact our treatises do not employ it. Their statements are thus only of value as generalized prescriptions of relative duration; ...".

Rules for syllable division should also be mentioned here. With regard to their grammarians Classical Greek and Sanskrit shared some similarities concerning syllable division.[25] The main two rules are summarized as follows:

[25] Similarities were also found in Latin (see Allen 1965: 89).

(16)

a. an intervocalic consonant is syllabified to the following vowel: VCV → V.CV (where . indicates a syllable boundary),

b. two successive intervocalic consonants are syllabified in two ways: either each consonant belongs with a distinct vowel or the consonant sequence belongs with the following vowel: VCCV → either VC.CV or V.CCV.[26]

(cf. Allen 1968, 1973)

Although the grammarians discussed syllable division, this was not taken into consideration in arguments on syllable quantity; this is discussed later.

Both the Classical Greek and the Sanskrit grammarians also shared the concept of syllable quantity (cf. Allen 1953, 1973: 53-54).

(17) 'Heavy' describes

a. a syllable containing a long vowel

b. a syllable containing a diphthong

c. a syllable containing a short vowel followed by a consonant-group (or by a final consonant *in pausa* in Sanskrit)

or d. a syllable containing a final short vowel *in pausa* may be lengthened (in Sanskrit).

(18)

'Light' describes a syllable containing a short vowel not followed by a consonant sequence or another (different) vowel.

The entities defined in (17a, b) are considered as 'long by nature' ('heavy by nature'), on the other hand, the grammarians in the classical period, according to Allen (1953, 1973), explained the entities defined in (17c) using a philosophical expression 'long by convention' or 'long by position' ('heavy by convention' or 'heavy by position').[27] This expression refers to the syllable, containing a short vowel followed by two (or more) consonants, which becomes heavy. However, this does not mean lengthening of the short vowel (cf. Allen 1973: 54). Moreover, VCC would not form one syllable if the syllable division stated in (16) were respected: VCC → VC.C or V.CC.

There was evidence concerning the syllable division describes in the expression 'long by position'. According to Allen (1973: 54), both Dionysius

[26] The RP (Ṛk-Prātiśākhya) school allows this division.

[27] See Hayes's (1989: 258) rule 'Weight by position', which seems to make use of this term.

Thrax and Hephaestion stated that when a syllable ending in a single consonant is followed by a syllable beginning with a consonant, for example, *ep.gon* or *al.loc*, it would be considered as 'long by position'. However, a VCCV sequence is sometimes syllabified as V.CCV. Allen (1973: 54) states, "Both Dionysius's and Hephaestion's statements reveal the difficulties caused by an inadequate theory of syllabification". I assume that the expression 'an inadequate theory of syllabification' in Allen's statement is considered for metrical purposes, otherwise, it seems to be too strong from the viewpoint of general syllabification. However, these examples suggest that describing syllable quantity by counting every segment in a syllable is rather inappropriate, since the first syllable in the example words consisting of a short vowel and one consonant will be one and a half morae, if the Rhythmici's definition of the length of segment is respected. The result does not meet the condition for a heavy syllable, which has to contain two morae. This may be the reason why the Rhythmici seemed not to succeed in applying their idea involving the length for every segment. Allen's statement regarding this issue is given below.

> It will be noted that syllable-division and length of consonants are not employed in these statements of syllabic quantity. However, there was one exception provided by those favouring the RP[28], which states, (a syllable containing) a long vowel is heavy; and heavier if accompanied by a consonant; (a syllable containing) a short vowel with a (preceding) consonant is light; and lighter without the consonant. This suggests a series of four quantitative values, viz. 'Heavier' (2 1/2 mātrā), 'Heavy' (2 mātrā), 'Light (1 1/2 mātrā), and 'Lighter' (1 mātrā). But this distinction has no metrical consequences, and is not otherwise mentioned by the phoneticians.
>
> (Allen 1953: 86)

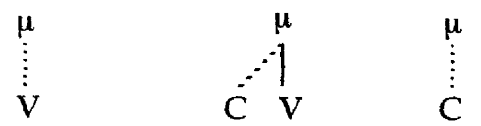
Allen's (1953: 86) statement here provides a clear implication concerning the less importance of onset consonant in terms of duration regarding syllable quantity for metrical purposes in the classical languages. Yoshiba, who tries to revive the notion of mora utilizing the length of segments in his theory, retains the idea of the Rhythmici for vowels and post-vocalic ('coda') consonants, but not for onset consonants. Thus, his interpretation of the notion of mora in (15) appears in the Mora Association Rules (MAR), in which Yoshiba treats a consonant not immediately followed by a vowel, i.e., a consonant in a 'coda'

[28] See fn 26.

position, as linked to a mora, which gives it the same length as a short vowel, but not a half of it. The MAR is illustrated in (19).[29]

(19) The Mora Association Rules

a. b. c.



(Yoshiba 1983: 23)

The MAR in (19) is applied in order: (i) every vowel is associated with a mora by rule (19a); (ii) every consonant immediately preceding the vowel which has already been linked to a mora is associated with the same mora by rule (19b); finally, (iii) each of the rest of the consonants is associated with an independent mora.

Assumptions regarding the prosodic nature of phonological strings the MAR indicates are: (i) a combination of a C and a V which immediately follows the C makes a natural unit, as does a vowel itself; (ii) a C does not make such a unit with an immediately adjacent consonant, therefore such a C makes a unit by itself (Yoshiba 1983: 133-134).[30] Thus, (19c) indicates that C associated with a mora on its own is in a coda position, whereas C in (19b) linked to a mora, which is also associated with a vowel, is in an onset position.

The arguments adduced by Yoshiba might lead us to expect that there is a length distinction between an onset consonant and a coda consonant. Application of one mora to a coda consonant, but not to an onset consonant, enables Yoshiba to account for a syllable consisting of a short vowel and a coda consonant with/without an onset consonant as heavy in a straightforward manner; such a syllable contains two morae.

Although Yoshiba's MAR shown in (19) suggests that there is a significant difference between the two types of consonant in terms of length phonologically, results of a phonetic experiment conducted in connection with the present study do not exhibit any such differences in length between an onset consonant and a coda consonant (see Appendix D).

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[29] This is a universal MAR. However, a language-specific modification may be considered; for example, the language in question needs to distinguish moraic consonants from non-moraic consonants, etc. (see Yoshiba 1983: 61 for discussion).

[30] The assumption (ii) is valid except in the languages where the string stop-liquid-V constitutes a single mora (Yoshiba 1983: 134). Such languages require a language-specific form of the MAR (see Yoshiba op. cit.: 108).

1. 2. 4 Hyman's Theory

Hyman's basic concepts concerning moraic theory is briefly summarized, and then the drawbacks concerning the absence of a syllable node in his model and the problem found in the representation of glides are discussed.

1. 2. 4. 1 A brief summary of Hyman's theory

Hyman observes that the distinction between heavy and light syllables has long been discussed (cf. McCarthy 1979, Halle and Vergnaud 1980, Hayes 1981, Clements and Keyser 1983). Hyman (1985) states that certain segments within the rhyme contribute to the weight of a syllable. These 'weight bearing units' have traditionally been termed 'morae'. A light syllable contains one mora: (C)V, a heavy syllable contains two morae (cf. McCawley 1968, de Chene 1979): (C)V_1V_2 (where $V_1=V_2$ or $V_1 \neq V_2$), or (C)VC, and a super-heavy syllable consists of more than two morae, a type occurring in languages such as Arabic (cf. McCarthy 1979): (C)VVC, (C)VCC.

The weight unit (WU) that corresponds to the traditional notion of 'mora' is represented by Hyman as 'x', to which each melody segment, categorized by +/- specifications for the [cons] feature, is linked underlyingly. The underlying associations between melodic segments and WU's undergo both universal and language-specific rules. The structures in (20) depict the Onset Creation Rule (hereafter OCR), which is the most important universal rule in Hyman's theory. (20b) provides exemplification for the more general representation in (20a).

(20) a. b.

(Hyman 1985: 15)

As can be seen in (20), a WU associated with [+cons] (exemplified in *t* in (20b)) is dissociated from its WU as a result of the OCR. The interpretation of this is that the WU associated with a [+cons] segment is deleted whenever it is followed by a [-cons] segment, and the [+cons] segment is reassociated with the x linked to the melodic segment characterized as [-cons] to its right. Consequently, two WU's are reduced to one.

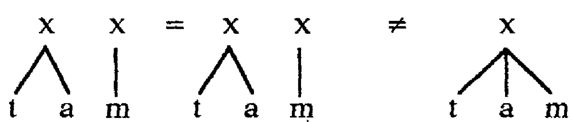
The next rule to be mentioned is the Margin Creation Rule (MCR), which concerns a [+cons] segment preceded by a [-cons] segment. A sequence comprising CVC undergoes the MCR unless the language in question treats such a sequence as a heavy syllable. In other words, a post-vocalic C loses its WU and relinks to the WU to its left, which is associated with a [-cons] segment. CVC sequences undergoing the MCR are found in languages such as Huasteco (cf. Hyman 1985), Dagur Mongolian (cf. Austin 1952)[31], etc. The relevant structures are diagrammed in (21). Structurally this could be regarded as the mirror image of the OCR. However, unlike the OCR which is universal, the MCR is a language-specific rule.

(21) a. b.

(Hyman 1985: 18)

Next, I would like to draw attention to a seemingly controversial point in this system; namely, that 'syllabicity can occur without syllables'. Hyman (1985: 20) assumes that syllabicity is executed by the most sonorous segment associated with a WU, which defines a 'beat' or peak of sonority. This suggests that if a segment retains its own WU, it will be syllabic. In other words, if an 'x' is not affected by any 'x-deletion rules' such as the OCR or the MCR, syllabicity remains, since each WU defines a 'beat'. For example, a CVC sequence word like 'tam' could be represented either as in (22a) or as in (22b).

(22) a. b.



(Hyman 1985: 21)

The MCR operates in (22b) and consequently, a consonant *m* loses its own WU and is incorporated into the preceding WU dominating a vowel and its onset consonant. On the other hand, Hyman (1985: 21) explains the presentation given in (22a) as follows: "there can be no opposition between CV-C and CV-C̩where in both cases the final C has an x of its own". Therefore, both of the post-vocalic consonants in (22a) will be interpreted as syllabic. To sum up this discussion, Hyman states (op. cit.), "only consonants

[31] Though velar nasals are exceptional in not undergoing the MCR (Austin 1952).

whose WU survives the entire derivation will be syllabic on the surface... the same feature matrix may be syllabic in one case, but not in another".

1. 2. 4. 2 Problems about 'syllabicity without syllables' and glides

Odden (1986) raises the criticism that under Hyman's assumptions, it is not possible to distinguish between elements which only differ in syllabicity: for example, the American English word 'ear' [ir] vs. (reduced) 'your' [yr̩] (presumably in general American pronunciation).[32, 33] Even though both words share the same segmental make-up, one is realized as a non-syllabic r whereas the other is realized as a syllabic r̩. Odden (1986: 670), then, argues, "syllabic r̩ must be diacritically 'more sonorous' than non-syllabic r".

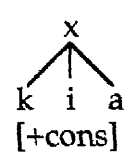
He adds another example regarding the contrast between syllabic and non-syllabic consonants in the same context, which cannot be accounted for by Hyman's assumptions:

> Following Hyman, we should never find a contrast between preconsonantal syllabic and non-syllabic C's in comparable environments. But Kimatuumbi contrasts stem-initial syllabic *n* in words like *ncheche* 'four' vs. non-syllabic *n* in *njeei* 'monkey';...
>
> (Odden 1986: 670-671)

I shall discuss this issue, which also relates to the moraic nasal in KiMvita and Japanese, in the following chapters.

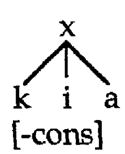
With respect to the analysis of glides, Hyman employs the feature [±cons] in order to distinguish glides from vowels: vowels have a [-cons] feature while glides have a [+cons] feature on the surface, which is derived from an underlying [-cons] feature in most languages. Hyman seems to manage to deal with this problem by noting the [±cons] feature in the structures. They are illustrated as follows.

(23) a.



[kja]

b.



[kia]

(Hyman 1985: 78)

---

32 Noske (1992) also makes this point.

33 In Odden (1986), a circled diacritic subscript ̥ is used, however, it is replaced with ̩ following the International Phonetic Alphabet here. In addition, presumably the actual pronunciation of 'your' involves a retroflex schwa, [jɚ], (Hayward, personal communication).

The glide is found (marked as [+cons]) in *kia* in (23a), while (23b) displays the high-vowel *i* marked as [-cons]. However, such use of the [cons] feature could cause redundancy when a high vocoid retains its [-cons] feature on the surface, as in (23b). Moreover, if a glide starts with a [+cons] specification, then both the [+cons] and [-cons] features in surface structures will be redundant.

When the [+cons] feature is considered for an underlying specification of a glide, it will create a problem for a case in which glides and vowels form a natural class. Such a phenomenon, according to Odden (1986: 672) is seen in Sinhalese, spoken in Sri Lanka, where a post-consonantal glides and vowels contrast lexically, e.g., /potw/ 'core' vs. /putu/ 'chair'. In such a case, a glide must be specified as [+cons] underlyingly. However, in Sinhalese, glides and vowels form a natural class for Root Vowel Deletion and OO-Plural Formation (see Feinstein 1979: 263 and 266 respectively). This practice will need careful treatment and will be discussed in 2.4.4.

1. 2. 4. 3 Other contentious issues in Hyman's theory

I would like to take up two more contentious issues that appeared in Hyman's theory: the syllabification of uninterrupted vowel sequences; and 'the major class features'.

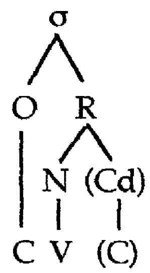
1. 2. 4. 3. 1 Syllabification of uninterrupted vowel sequences

Hyman's treatment of uninterrupted vowel sequences adds an issue to syllabification theory, namely, that of partial syllabification.

Hyman's intriguing idea of syllabicity without syllables seems to allow any segment not to be syllabified providing it retains its own WU. We have already seen this idea, and that it was critcized by Odden (1986). Starting from a different point of view to Odden's, this idea seems to carry an implication of the possibility of partial syllabification.

In the traditional syllable template, a rhyme constituent has always to be present, but as depicted in (24), we can see that an onset consonant generally appears to be an essential constituent of syllable structure as well.

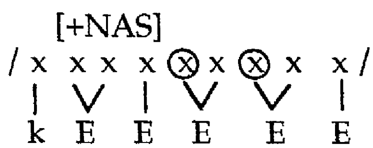
(24)



But what happens if onset consonants are absent?

Hyman (1983, 1985) has challenged the usual assumption that each vowel in a sequence of uninterrupted vowels is automatically syllabified. He (op. cit.) argues this on the basis of words in the West African language Gokana such as *kɛ̃ɛ̃ɛ̃ɛ̃ɛ̃ɛ̃* 'woke him up'. He claims that Gokana phonology dispenses with syllables (see Hyman 1983, 1985 for detail), however, syllabicity is defined by a WU itself. Thus, a segment which retains its own WU is considered as syllabic without necessarily associating it with a syllable. The underlying representation of the sequence *kɛ̃ɛ̃ɛ̃ɛ̃ɛ̃ɛ̃* is shown in (25). (It should be remembered that Hyman represents his weight units (=morae) by means of x's.)

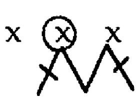
(25)



(Hyman 1985: 24)

Hyman (1985: 23-24) explains that derivation of the string of six identical vowels in *kɛ̃ɛ̃ɛ̃ɛ̃ɛ̃ɛ̃* from eight underlying [-cons] WU's is as a result of the 'degemination rule' (Hyman, op. cit.: 26), which says, "whenever one has a geminate segment, i.e., two WU's joined together to a segmental matrix ... the x of the geminate is deleted". In (25), deleted x's result from the degemination rule as illustrated in (26).

(26)

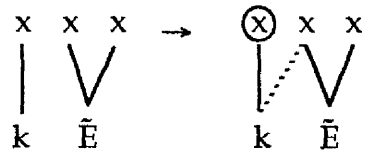


(degemination)

(Hyman 1985: 26)

The first segment *k*, which obviously has the [+cons] feature, is to undergo the OCR. Since the OCR takes place between *k* and the first Ẽ, meaning that the second WU becomes branching as in (27), and because this does not meet the structural description in (26), this WU is not deleted in accordance with the degemination rule.

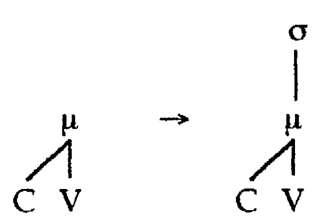
(27)



Only the first two $\tilde{E}$'s obtain an onset consonant while the remaining $\tilde{E}$'s retain their x's and stand alone. Since, according to Hyman, Gokana does not have syllable structure, retaining WU's is sufficient to be considered capable of constructing a syllable. If this is so, a left-branching WU, meaning that the OCR has taken place, should be differentiated from a non-left-branching WU in a language which requires a syllable. In fact, Hyman (1983: 178) states, "If syllable structure is metrical, it should share properties and potentials with other metrical phenomena. One such related phenomenon is foot structure. Hayes (1981) has recently analyzed Latin ... footed and unfooted syllables in Latin, ... in Gokana ... there are syllabled and unsyllabled segments". Hyman's argument concerning the treatment of uninterrupted vowel sequences is thus interpreted as follows: such a sequence would, at best, be only partially syllabified.

However, in the case of Japanese (and possibly other languages), even if a segment retains its own mora, this does not guarantee that it will be syllabic in the sense of 'being capable of constituting the nucleus of a syllable'. We have not discussed syllabification yet, which will take place in chapter 2. For the time being, we can say that a syllable can be regarded as a structure that is projected whenever a CV sequence has undergone the OCR. Provisional syllabification is illustrated below.

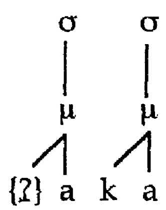
(28) Provisional syllabification



This syllabification suggests that a consonant on its own or a vowel on its own may not constitute a syllable. Extending the idea of partial syllabification Hayward (1997) has argued that in some languages even word/phrase-initial vowels are only syllabified if an onset is provided in some way.

An onset consonant does not always appear to be available for syllable structure when a word begins with a vowel underlyingly. However, a glottal stop, in fact, is often perceptible in pronunciation and plays a role as an onset consonant in orthographically vowel-initial words in many languages such as Japanese, English and so forth. Hence the glottal stop, {ʔ}, is often displayed in the onset consonant position in a structure for an orthographically vowel-initial word.[34] For example, the Japanese word *aka* 'red' would be represented as in (29).

(29) aka



In (29), the glottal stop is in brace brackets, which indicates that it is an epenthetic segment, and this practice is continued throughout this thesis. Following Hyman (1985: 65), such an epenthetic segment is not associated with its own mora in the underlying representation, but is directly associated with a mora linked to the following vowel; thus no OCR takes place.[35]

There is a slight difference between my assumptions about epenthetic segments and Hyman's. He (op. cit.: 66) states, "... The claim implicit in this approach is that epenthetic segments make other WU's pronounceable - thus, unlike most approaches to epenthesis, I do not make the assumption that epenthesis is related to syllable structure - at least, not directly". However, like most approaches to epenthesis, my assumption of epenthetic segments is directly related to syllable structure. In other words, epenthetic segments allow other morae to be syllabified, and if there is no such segment then other morae are not syllabified.

[34] A detailed discussion concerning vowel-initial morphemes is found in 5.3.2.2.2.

[35] This is another area of Hyman's theory which should be looked at carefully. It will possibly be future research.

1. 2. 4. 3. 2 The major class features

The major class features could be defined as the features the presence or absence of which distinguish classes such as consonants, vowels, glides, and sonorants (nasals and liquids), which make up the sounds of speech. In Hyman's theory, the [consonantal] feature with a +/- specification is utilized.

In all feature systems seen in the literature up to the period when Hyman's weight-unit ideas were introduced, each feature had a binary function, i.e., +/- specification such as [+cons] and [-cons]. For example, in the Chomsky and Halle (1968) feature system, [±consonantal], [±sonorant], and [±syllabic] are exploited. Later, [±syllabic] was removed because if phonological theory allowed a distinct syllable tier, the [syllabic] feature would become redundant. For example, in CV phonology (Clements and Keyser, 1983), the CV-tier itself indicates the [syllabic] feature, i.e., a consonant on the CV-tier provides a [-syllabic] feature and likewise a vowel provides a [+syllabic] feature. As a result, only [±consonantal] and [±sonorant] are found in their feature system.

However, among current phonological theories, unary specification in feature systems seems to have been preferred. Following McCarthy (1988), Hayward (1997: 55) has replaced the major class features with +/- specifications by monovalent features such as [consonantal] and [sonorant] (abbreviated to [C] and [S] respectively). The classes are: obstruents, represented by the [C] feature; vowels and glides, represented by the [S] feature; nasals and liquids, represented by both [C, S] features. I adopt Hayward's feature system in this study.

(30) The major class features.

Obstruents = [C]   Vowels/Glides = [S]   Nasals/Liquids = [C, S]

One of the advantages over the monovalent major class feature system is that both glides and vowels are represented by the [S] feature; this can handle the case where glides and vowels form a natural class (see Odden 1986). In KiMvita, as I will discuss later, high vocoids exhibit three different phonetic realizations (see 3.3.2.2), in which they have both consonantal and vocalic characteristics. Thus the term 'glide', which is generally represented as expressing a consonantal feature, could be interpreted as '(pre-vocalic) high vocoid' in this study. The two glides, 'high back round vocoid' and 'high front vocoid', are notationally represented by /w/ and /y/ respectively. However, such representations do not suggest that high vocoids are underlyingly glides, anymore than my use of the term 'glide' implies consonantality.

1. 2. 5 Hayes's Theory

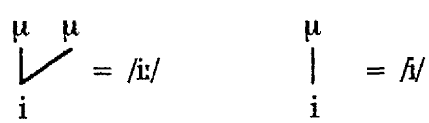
Hayes (1989) tries to maintain Odden's objection to Hyman's theory. Thus, Hayes proposes that while glides are underlyingly not associated with a mora, vowels are. Intrinsically, therefore, Hayes's theory could provide a better explanation of the contrast between syllabic and non-syllabic segments in the same context. Noske (1992), however, criticizes Hayes's model for violating the basic principles of autosegmental and metrical phonology. He claims that Hayes's theory is a mixture of autosegmental and metrical phonology, but that his theory seems not to obey their respective restrictions. First of all, however, Hayes's theory, especially as it relates to underlying forms and basic syllabification, is briefly sketched out. Then I shall look at two points that create serious violations of the principles of autosegmental and metrical phonology.

1. 2. 5. 1 A brief summary of Hayes's theory

To begin with, association of morae in underlying forms is considered. Unlike Hyman's theory, the underlying association of a mora depends on a segment type. For example, vowels, and geminate consonants are associated with morae underlyingly, whereas ordinary short consonants and glides are underlyingly moraless. However, some short consonants other than those in an onset position come to be associated with a mora by a rule. Long vowels are associated with two morae whereas short vowels are associated with one, as illustrated in (31).

(31)

a. b.



(Hayes 1989: 256)

With regard to glides, there is no underlying association between a segment and a mora, which contrasts with a corresponding short vowel; using the same notational convention compare (32) with (31b).

(32)

i = /y/

(Hayes 1989: 256)

The representation of the glide as in (32) is identical to that of any ordinary short consonant, as in (33).

(33)

n = /n/

(Hayes 1989: 256)

Geminate consonants are associated with one mora like a short vowel, since as Hayes (1989: 257) states, in most cases geminate consonants bear a mora.[36]

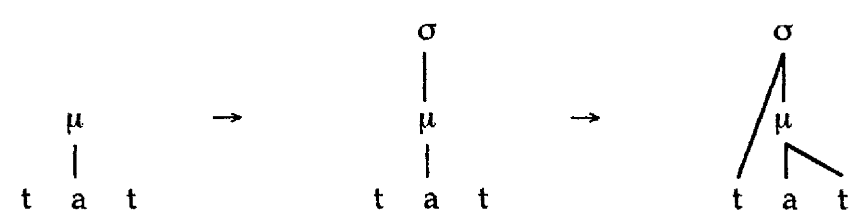
(34)

μ
| = /nn/
n

(Hayes 1989: 257)

The next point concerns syllabification in Hayes's theory. It takes place briefly in the following manner: (i) a selected sonorous moraic segment is dominated by a syllable node, (ii) an onset consonant is then associated to that syllable node, while a coda consonant is associated to the preceding mora, unless it is assigned a mora by a rule (Hayes 1989: 257). The procedure for the syllabification of a CVC sequence realized as a light syllable is diagrammed in (35).

(35) a. b. c.

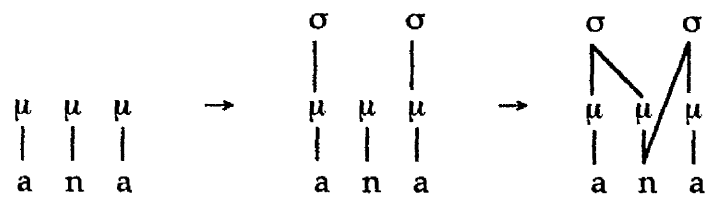


[36] Hayes (1989: 257) states that there are languages like Kimatuumbi (Odden 1981) and Gokana (Hyman 1985: 42) which contain long syllabic consonants such as [m̩m̩], which link to two morae underlyingly; however, this configuration is rare, μ μ
|/
m.

In Hayes's model, an onset consonant links directly to a syllable node, thus differing from onset consonants in Hyman's theory. On the other hand, a coda consonant, if it is moraless underlyingly, is linked to the preceding mora.

Let us consider the syllable structure for a geminate consonant as an onset consonant. As can be seen in (36) below, a segment /n/ is associated with a mora as an underlying geminate consonant and it also comes to be associated rightwards directly with a syllable node.

(36)



(Hayes 1989: 258)

Hayes (op. cit. : 257-8) explains this syllabification as follows; "... an underlying geminate (one mora) or long syllabic consonant (two morae) has its consonant melody "flopped" onto a following vowel-initial syllable".

1. 2. 5. 2 Theoretical implications for autosegmental phonology

In Hayes's model, two major violations of principles in autosegmental phonology are found. A key device in autosegmental theory is the establishment of tiers on which segments are arranged in linear order, and procedures are established for linking segments on one tier with those on another (cf. Goldsmith 1976, 1990). The principle of 'planar tier locality' and the prohibition against crossing lines have to be respected. In other words, when association occurs between two segments on distinct tiers, the two tiers should be adjacent to each other. In Hayes's structures shown in (35), while vowels and coda consonants are associated with morae on the mora tier, syllable-initial consonants are directly associated with a syllable node on the syllable tier. Hence the structures in (35) violate the principle of planar tier locality.

The next point concerns the association conventions in autosegmental phonology, which are as follows:

(37) Association Conventions

a. Mapping

Insert association lines between *one* tone and *one* TBU - going from left-to-right/right-to-left - starting with the leftmost/rightmost tone and TBU.

b. Dumping

Leftover tones are associated to the nearest TBU to their right/left.

c. Spreading

Leftover TBU's are associated to the nearest tone to their left/right.

(Noske 1992: 19)

Noske (1992: 45) observes that although Hayes does not explicitly state a concept of association of an onset consonant directly to a syllable node, the association of an onset and a coda consonants as depicted in (35) employs the autosegmental convention of dumping. However, in the case of a geminate consonant, Hayes uses the term 'flopping' for the association of a geminate consonant as an onset consonant. Noske (op. cit.: 46) points out that flopping differs from dumping. As can be seen in (36), a consonant associated with a syllable node in order to be an onset of the following syllable is already associated with a syllable constituent, a mora. In the concept of dumping, however, there is no previous association with a syllable constituent before association takes place.

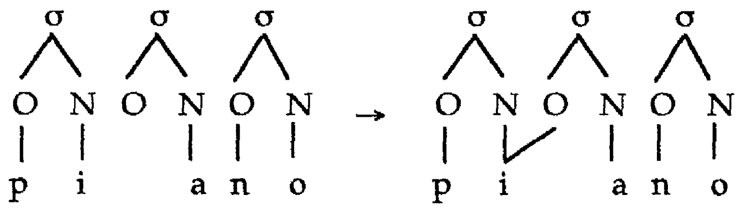
The mechanism of flopping creates a problem when one of the association conventions in autosegmental phonology, namely 'spreading'[37], takes place. Concerning this point, Noske (1992: 54) states, "Although the notion of spreading plays a crucial role in the account of CL[38] in moraic theory, other apparent occurrences of this mechanism cannot be accounted for because the node to which spreading should take place is lacking". This is seen in a case where the spreading occurs to an onset position. For example, a word 'piano' is realized as [pijano] as a result of spreading the preceding high vowel to an onset position. An insertion of a homorganic glide after a high vowel is a well-attested case cross linguistically. In such a case, 'flopping' has to be invoked in Hayes's theory, just as seen in the case of a geminate, since an onset consonant is never associated to a mora. However, 'spreading' itself differs from

[37] Spreading was originally formulated for dealing with unassociated tone bearing units, which come to be associated with the nearest tone.

[38] CL stands for 'Compensatory Lengthening' (See Hayes 1989 for details).

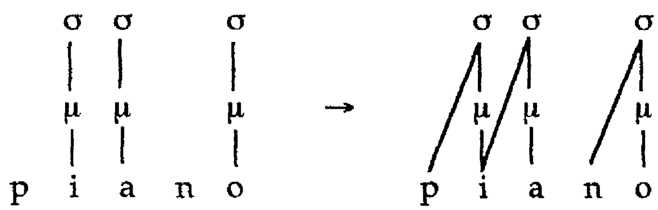
'flopping'. Compare the spreading in a full syllabic constituent as depicted in (38) to that in Hayes's moraic model in (39).

(38)



(Noske 1992: 54)

(39)



(Noske 1992: 54)

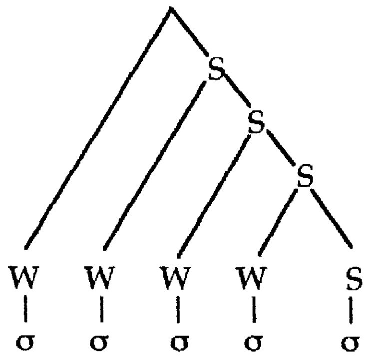
As can clearly be seen from the structures in (38) and (39), on the one hand, the spreading takes place between the same phonological tier levels, in this case N(ucleus) and O(nset), as in (38). On the other hand, in (39), which is based on Hayes's model, the segment *i*, linked to a mora, has to be associated with a syllable node in order to be an onset of the following syllable. This is because there is no node to which the spreading occurs.

A problem concerning Hayes's account for this issue is that while 'flopping', which is not a general principle anyway, requires to be stated as a rule, 'spreading', as a general convention, needs not to be stated as a rule for such a specific occasion (Noske 1992: 55).

1. 2. 5. 3 Theoretical implications for metrical phonology

In metrical phonology, the principle of 'binary branching' must be obeyed: nodes are S(trong) and W(eak). The following diagram shows a correct structure for a right dominant (unbounded) foot containing five syllables.

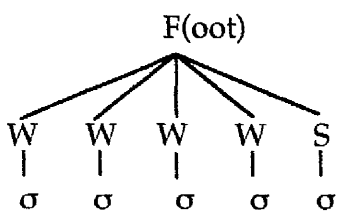
(40)



(Noske 1992: 51)

The structure in (40) perfectly satisfies the principle of binary branching. On the other hand, the diagram in (41) does not respect binarity.

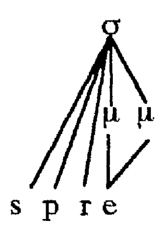
(41)



(Noske 1992: 52)

However, although Hayes (1981, 1982) would forbid a structure such as (41), n-ary branching does appear to be allowed in the case of syllable-initial consonants in Hayes's model to account for complex onsets, as in (42). An example is [spre:] in [spre::k] 'speak' in dialectal German, which has been historically derived from [spre:kə] by schwa loss with compensatory lengthening (Hayes 1989: 292).

(42)



Noske (1992: 52) advances the following argument with respect to this structure: "If one does assume branching nodes below the level of the syllable

for onset consonants, this means that one has to identify which nodes contribute
to weight and which do not. The direct representation of syllable weight in geometrical terms, which ... is one of the advantages of Hayes's theory, would be lost".

1. 3 The Theoretical Framework to be Adopted in this Study

Some differences between Hyman's and Hayes's theories have been seen and illustrated in the summaries of the two theories in the above sections. The first point relates to a model of moraic structure. In Hyman's model, the essential constituent is the mora only, whereas two phonological constituents, the mora and the syllable, are exploited in Hayes's model. Another difference between the two theories lies in the status of onset consonants. On the one hand, Hyman's theory treats all segments as the same at the starting point, meaning that each segment is linked to a WU, suggesting that each segment is potentially syllabic. However, after undergoing rules such as the OCR or the MCR, certain segments lose their weight and potential syllabicity. On the other hand, within Hayes's theory, an onset consonant is directly attached to the syllable node. In other words, there is no mediating element such as a mora between an onset consonant and the syllable node, whereas a mora is a mediator between segments in the rhyme and the syllable node. This kind of association suggests that there could be no simple way of accounting for a word-initial moraic consonant. In the following paragraphs, I shall decide which theory is to be followed for analysis of the 'moraic' nasals in this thesis.

First of all, Hayes's theory is rejected, since as already discussed above, although his theory uses principles of autosegmental and metrical phonology, his model violates those principles. Moreover, his model would be problematic when 'spreading' involves an onset consonant position as illustrated in 1.2.5.2. One crucial defect, especially for one of discussing points in this thesis, is that Hayes's model seems not to be able to handle the analysis of a particular type of moraic consonant, namely a word-initial one, in an elegant manner. In his model, a word-initial moraic nasal will require a plausible explanation/rule to construct its own syllable.

With regard to Hyman's theory, no serious objection needs to be raised about the model, apart from the problem of distinguishing high vowels from glides, which will be discussed in a later chapter.

Although the two points regarding the glide formations and the 'syllabic' consonants highlighted above will need careful treatment, this study will essentially follow the conceptual framework of Hyman's moraic theory.

Chapter 2
The Syllable and Syllabification

2. 0 Introduction

The concept of the syllable has been utilized in various aspects of phonological phenomena since the Greek period. However, views of syllable structure vary among theories. The main discussions in this chapter concern the concept of the syllable and the concept of syllabification. First of all, the concept of the syllable and the representation of syllable will be sketched out in section 2.1. A syllable structure containing an internal hierarchical structure, as advanced by Halle and Vergnaud (1980), Kaye and Lowenstamm (1984), Selkirk (1982), and Lapointe and Feinstein (1982), among others, is considered first, and compared with one containing no such internal hierarchical structure, as advocated by Clements and Keyser's (1983) CV phonology, and the moraic theory based on Hyman's (1985) 'Weight Theory'. The concept of syllabification will be dealt with in section 2.2, where, firstly, I will raise the question as to whether syllables are derived or underlying. Following this, I shall discuss the nature of syllabification, i.e., whether it is exhaustive or partial; which is followed by a discussion on 'resyllabification' in 2.2.3. Previous studies on syllabification; the rule-based approach advanced by Kahn (1976), and Steriade (1982), among others, and the templatic approach held by Selkirk (1982), and Itô (1986, 1989), among others, will be outlined in section 2.3. Then rules and conditions for the syllabification in the moraic theory employed here and the syllabification of an uninterrupted vowel sequence will be discussed in section 2.4.5.

2. 1 The Concept of the Syllable

Although the syllable is an essential entity in phonological structure in most theories, it seems to be difficult to define the syllable precisely. Firstly, we should consider the consensus on the syllable, and then the motivation for the syllable is taken up. Following this, the representation of syllable within most versions of non-linear generative phonology, CV phonology, and the moraic theory employed here is discussed. In section 2.1.3, the syllable inventories for KiMvita and Japanese are briefly outlined; the inventory of syllables in KiMvita will be discussed in detail in chapter 3; but in chapter 4 (KiMvita) and chapter 5 (Japanese), I shall argue that a moraic nasal does not construct a syllable on its own. Based on Hayes's (1989) claim, i.e., that universally the maximum number of morae per syllable is two in the lexicon, I shall discuss why a super-heavy syllable, containing three morae, is a marked case in Japanese. Two pieces of evidence from Japanese will be provided, and some supporting evidence from Saho (Hayward 1997) will be adduced.

2. 1. 1 The Definition of Syllable

In this section, evidence for the syllable is investigated from various perspectives. Firstly, the internal organization of the syllable is looked at. Then I shall investigate why syllables are required as phonological constituents. Finally, the relation between syllables and sonority is focused upon.

2. 1. 1. 1 The syllable and its constituents

There has been no clear definition of the syllable which has appeared in the literature so far. However, Pike and Pike (1947: 79) state, "The syllable must be divided into margin and nucleus...". Following them, a general agreement on the syllable among most phonologists seems to have been arrived at. The syllable consists of an onset, a nucleus and a coda, for the term margin has been replaced with onset and coda[1] respectively. I shall cite Clements and Keyser's (1983: 11) statement:

> Many writers of the past (Trubetzkoy 1958, Pike and Pike 1947, Haugen 1956) and present (Selkirk 1978, Halle and Vergnaud 1980) have proposed a further set of constituents smaller than the syllable, taking consonant and vowel segments as their members. These constituents may be termed the onset, nucleus, and coda.

In general, it is said that the nucleus is an obligatory constituent of a syllable while the onset and the coda are optional (see Halle and Vergnaud 1980: 93, Lapointe and Feinstein 1982: 74, Selkirk 1982: 345). However, in the moraic theory this thesis employs, it is arguable that an onset consonant is

[1] A theory such as Government Phonology, however, dispenses with the notion of coda in a phonological structure (see Kaye, Lowenstamm, and Vergnaud 1985, 1990).

essential in order to construct a syllable. I shall discuss this matter in section 2.4.1.

There is one more syllabic constituent called the 'rhyme' which consists of the nucleus and the coda together. A nucleus may consist of two melodic segments at most. The structure of the rhyme determines two things: (i) it determines whether the syllable is open or closed; (ii) it determines whether the syllable is light or heavy. An open syllable ends in a vowel, while a closed syllable ends in a consonant. For example, the English words *key* /ki:/ is an open syllable whereas *cat* /kæt/ is a closed syllable. With respect to light and heavy syllables, it is said that the former type contains a short vowel rhyme and the latter type consists of a rhyme having a long vowel, a diphthong or sometimes a short vowel followed by a coda consonant. For example, *sil* of an Egyptian Arabic word *bisílla* 'green peas' is a heavy syllable, while *bi* and *la* of the same word are light syllables. However, in some languages, when a short vowel nucleus is followed by a coda consonant, the syllable type to which the sequence belongs is characterized as a light one (see Hyman 1985: 5-6).

2. 1. 1. 2 The necessity of syllables

We may raise the question as to why we need the syllable as a theoretical constituent. Motivation for the syllable as a theoretical construct has certainly been discussed among phonologists (see Selkirk 1982: 339, Kenstowicz 1994: 250-252, Blevins 1996: 207-210). According to their discussions, the following points are best accounted for with reference to the syllable: (i) phonotactic constraints; (ii) phonological rules.

First of all, regarding phonotactic constraints, a thorough study of the occurrence of Southern British English phonemes in syllables made by O'Connor and Trim (1973) illustrates this point very insightfully. For example, /h/ is not a possible normal simple post-vocalic ('coda') consonant and nor are /r/, /w/ and /y/,[2] whereas /ž/ and /ŋ/ are not possible word-initially. Distribution of such segments are explained in an efficient manner by employing syllables; viz., /h/ /r/, /w/ or /y/ is found only in an onset position while /ž/ and /ŋ/ occur in a 'coda' position. A phonotactic constraint on moraic nasals in Japanese also provides a piece of evidence for necessity of syllables. Based on the fact that moraic nasals never occur word-initially, but word-finally or word-internally, i.e., precisely in a position between post-vocalic and pre-consonantal positions,

[2] Concerning /w/ and /y/, they may not appear in such a position, however, this depends on a phonological analysis of diphthongs.

it can be generalized by employing the syllable. A moraic nasal is found only in a syllable-final position. The phonetic realization of the voiced stops, which are not components of prenasalized stops, in KiMvita is explained in a clear manner with reference to the syllable; i.e., that a voiced implosive stop occurs (exclusively) in an onset position while a voiced (ex)plosive stop is found in a 'coda' position.[3]

With respect to the second point, a syllable renders the statement of phonological rules simpler and more insightful. Two types of phonological rule are discussed, based on Kenstowicz (1994). The first type of rule concerns the assignment of stress.[4] Languages such as Egyptian Arabic and Latin provide good examples. In both languages, it may be roughly said that stress is assigned to the penultimate syllable if it is heavy, however, if it is light, stress is borne by the antepenultimate syllable. For example, in Egyptian Arabic, /ga.ríi.da/ 'newspaper', /bi.síl.la/ 'green peas', /ga.wán.ti/ 'gloves', and /ʕí.na.ba/ 'a grape' are found (examples are cited from Kenstowicz op. cit.: 292), while /con.féc.tus/ but /con.fi.ci.o/ typify Latin (Allen 1965: 83). In addition, subsidiary stress which may precede the primary stress in English is explained in terms of open vs. closed syllable contrast, for example, *a.trócious* vs. *Àt.lántic;* for some speakers of American English no subsidiary stress is found if a syllable preceding the primary stressed syllable is open while it is found if a syllable is closed. The second type deals with rules of phonological processes, which are best explained by the existence of the syllable. For example, vowel epenthesis may create a nucleus so that an unparsed consonant can be syllabified. The consonant cluster of the word 'rhythm', [ðm], is not a possible coda, and in this case vowel epenthesis takes place between [ð] and [m] in order for the sequence to be syllabified: as a consequence [rɪ.ðəm] is obtained (Kenstowicz op. cit.: 252).

To sum up, the syllable is a theoretical constituent, which can explain many phonological phenomena by employing certain natural categories such as 'syllable-initial' vs. 'syllable-final', 'open syllable' vs. 'closed syllable', or 'light syllable' vs. 'heavy syllable'. There is also the argument based on the sonority

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[3] The term '(ex)plosive' is used only in contrast with the term 'implosive'.

[4] The use of the term 'stress' should be noted here. Following Beckman (1986), the term 'stress accent' and the notation * to represent an abstract phonological diacritic, as found in autosegmental phonology, are better. However, in this study, the term 'stress' as a shorthand form for 'stress accent' and the notation ´ are employed to represent this feature both in the phonology and phonetics. In addition, as we will see in chapter 5, the term 'accent' refers to 'pitch accent' or 'non-stress accent' (in Beckman's terms) and the notation * is used for representing 'accent' phonologically and phonetically in Japanese.

cycle or the sonority hierarchy, which is a universal characteristic of speech sound. This is discussed in the following subsection.

2. 1. 1. 3 Sonority and syllables

A view that there is a close relationship between syllables and sonority has been recognized and discussed among linguists from early times, Sievers (1881) and Jespersen (1904), to date. For example, Sievers (op. cit. [in Clements 1990: 285]) observed that higher sonority is permitted to a consonant which is nearest to the nucleus. Jespersen (op. cit.: 188 [in Clements *ibid*.]) states that in every group of sounds there are just as many syllables as there are clear relative peaks of sonority.

The sonority theories are expressed in the Sonority Sequencing Principle (see Clements 1990, Blevins 1996), which governs the preferred order of segments in a syllable. I shall cite Blevin's version, which is termed the Sonority Sequencing Generalization (hereafter SSG), in (1).[5]

(1) Sonority Sequencing Generalization

> Between any member of a syllable and the syllable peak, a sonority rise or plateau must occur.
>
> (Blevins 1996: 210)

The SSG (and indeed any version of the sonority principle) says that sonority rises towards the nucleus and falls towards the syllable end. Thus, in general, a sequence of C_1C_2 ($C_1 < C_2$ in sonority) may occur before, but not after, a nucleus. However, evidence against the SSG is found; for example, in English, sequences such as *sp, st,* and *sk* occur both in an onset and in a post-vocalic ('coda') positions. Another counter-example is found in Welsh in the mutated form of the word meaning 'land', i.e., *gwlad*. The mutated form of such a word is the monosyllabic word *wlad*, [wla·d], in which a sequence *wl* constitutes an onset. As is obvious, such a sequence severely violates the SSG.[6] This kind of counter-evidence is reported cross-linguistically and is dealt with from various perspectives by phonologists (see Clements 1990, Blevins, 1996 for details).

Regarding sonority ranking, based on phonetic facts (see Ladefoged, 1993), the following hierarchical order is accepted universally; O < N < L < G <

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[5] Blevins explains that her version of the sonority principle includes syllable-initial/syllable-final geminates.

[6] Personal communication from Dick Hayward. The base form *gwlad* itself also violates the SSG, provided that *w* is not part of secondary articulation.

V, and within the same category a voiced segment is ranked as more sonorous than its voiceless counterpart (where O=obstruent, N=nasal, L=liquid, G=glide, V=vowel).

Clements (1990) observes that the SSG (and any version of the sonority principle) simply distinguishes two types of syllable; one conforms to the SSG and the other violates it. The former could be called 'unmarked' syllables and the latter 'marked' syllables. Clements makes the point that the SSG cannot rank syllable types in terms of relative complexity, which is based on the sonority distance between adjacent segments, and proposes the Dispersion Principle (DP). The DP stated within the notion of 'demisyllable', which is C_nV or VC_n (where $n \geq 0$), is as follows: (i) an initial demisyllable which maximizes the sonority distance is preferred; (ii) a final demisyllable which minimizes the sonority distance is preferred.[7] Based on the DP, a syllable is ranked by its degree of distance from the optimal syllable. For example, in initial CV demisyllables, a sequence of OV is the optimal and ranked as 1, while that of GV is the farthest from the optimal syllable and ranked as 4. In the case of syllable-final VC demisyllables, the mirror image of the initial-demisyllable-ranking is seen; thus a sequence of VO is ranked as 4. Complexity ranking for demisyllables of two and three members is shown in (2), where the numbers indicate the ranking. Abbreviations are the same as above.

(2)

a. Two-member demisyllables

	1.	2.	3.	4.
CV	OV	NV	LV	GV
VC	VG	VL	VN	VO

b. Three-member demisyllables

	1.	2.	3.	4.
CCV	OLV	ONV, OGV	NLV, NGV	LGV
VCC	VGL	VLN, VGN	VGO, VNO	VLO

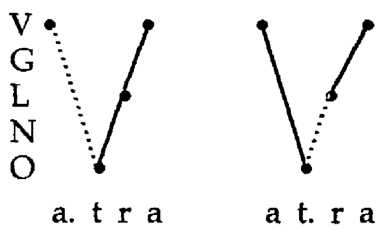
(extracted from Clements 1990: 305)

Kenstowicz (1994: 284) states that on the basis of the DP, the preferred syllabification for a stop-liquid sequence /atra/ is [a.tra], but not [at.ra]. He (*ibid.*) explains, "[at.ra] is dispreferred since the falling slope in the rime is steeper than the following rise". On the other hand, [a.tra], in which a syllable boundary

[7] See Clements (1990: 303-304) for details of the demisyllable and the Dispersion Principle.

comes between a nonsloping rhyme [a] and [tra], accords with the DP, i.e., [tra] is ranked as 1; an onset has an optimal rising slope.[8] I shall cite diagrams that appear in Kenstowicz (*ibid.*) in (3), where a dotted line (mine) indicates a syllable boundary.

(3)



2. 1. 2 The Representation of Syllable

In this subsection, I shall look at three different types of representation of the syllable. These fall into two groups; one in which the syllable has an internal hierarchical structure; the other in which the syllable contains no internal hierarchical structure. The former is seen in most versions of non-linear phonology while the latter is found in CV phonology and the moraic theory.

2. 1. 2. 1 Most versions of non-linear phonology

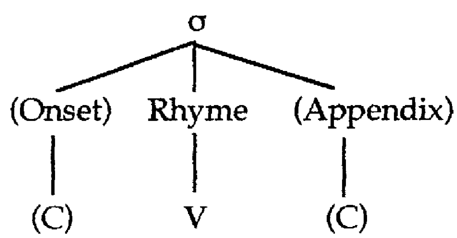
Representation of syllable structure within most versions of non-linear phonology varies slightly according to the practitioner. For example, in the Halle and Vergnaud (1980) model, the syllable consists only of an obligatory constituent, Rhyme, and two optional constituents, Onset and Appendix, whereas Lapointe and Feinstein's (1982) syllable formation is more complicated. A syllable is divided into Onset (O) and Rhyme (R), and the latter is further divided into Nucleus (N), Coda (Cd) and Appendix (Ap). Moreover, a Nucleus is broken down into a Peak (Pk) and a Satellite (Sat). The representation of syllable structure held by Selkirk (1982) shows a branching tree with no labelled nodes, however, such a tree implies Onset, Rhyme, Peak, and Coda nodes. These three different types of syllable structure are illustrated in (4). With regard to (4a), I draw a diagram in accordance with Halle and Vergnaud's (1980: 93) description of syllable structure for all languages. Based on such a universal syllable model, a language-specific syllable structure has to be

[8] See Kenstowicz (1994: 284) for more discussion concerning the DP.

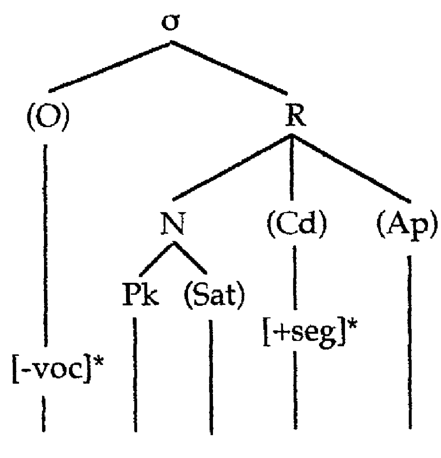
stipulated. For example, the canonical syllables of Arabic contains a branching Rhyme; R
/ \
V (V/C).

(4)

a. Halle and Vergnaud's syllable model

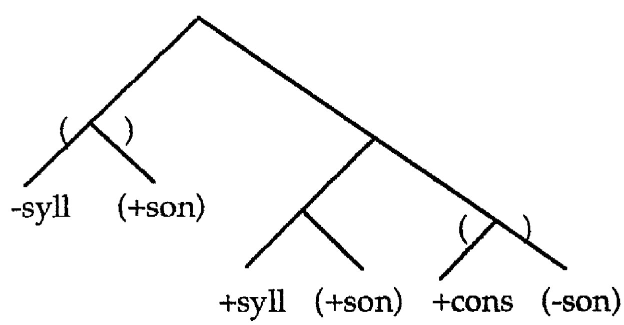


b. Lapointe and Feinstein's syllable model



(Lapointe and Feinstein 1982: 74)

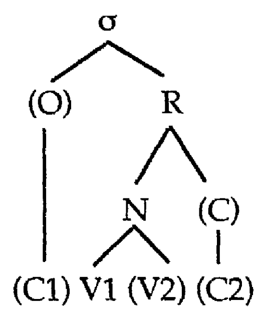
c. Selkirk's syllable model



(Selkirk 1982: 344)

These three structures have one thing in common, a branching rhyme, and this is a characteristic point of most versions of non-linear phonology. Furthermore, as I have mentioned above, these three syllable structures indicate the Onset constituent as optional. Representation of syllable structure and its terminology may be generalized as follows; a syllable consists of an Onset and a Rhyme. A Rhyme may branch if a string contains a coda consonant or the second vowel as in Halle and Vergnaud's model, while a Rhyme is further divided into a Nucleus and a Coda as seen in Lapointe and Feinstein's model and Selkirk's structure. The generalized syllable structure of the latter two models is illustrated in (5).[9] Major class features should appear in the segmental matrices, however, C and V are used for ease of representation.

(5)



We have already seen that according to all these approaches a heavy syllable, containing a long vowel, a diphthong or a short vowel followed by a coda consonant, is determined by whether or not the rhyme is branching. In the case of a long vowel and possibly for a diphthong, only a branching nucleus would be seen in such a structure. On the other hand, in the case of a short vowel followed by a coda consonant, a branching rhyme is the only possibility. However, this kind of structure might actually be categorized as a light syllable in some languages, as Hyman (1985) points out. This suggests that the syllable structure depicted in (5) does not make a clear distinction between light and heavy syllables. I shall address this issue in 2.1.2.3.

2. 1. 2. 2 CV phonology

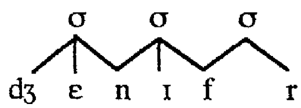
Clements and Keyser's (1983) syllable structure originates from Kahn's (1976) representation of the syllable. Kahn's work remarkably well demonstrated the syllable as a necessary hierarchical constituent in phonology. However, the

[9] See also Cairn and Feinstein (1982: 196) for a universal syllable template.

syllable structures advanced by these linguists contain no internal hierarchical structure - unlike the syllable structure seen in most versions of non-linear phonology.

Clements and Keyser (1983: 3-4) take Kahn's representation of a word such as 'Jennifer' as an example, depicted in (6),

(6) Jennifer



and argue that there are two flaws regarding his two-tier syllable structure, namely: (i) it fails to characterize the notions 'possible initial and final clusters' (in English); (ii) it does not distinguish the syllable peak from marginal elements. With regard to the flaw (ii), Clements and Keyser argue that in Kahn's model it is difficult to judge which segment is a peak and which is not, for example, *rl* in a word *earl*. In Kahn's model, this sequence is dominated by a single syllable node, meaning that either of them may be in the peak.

Clements and Keyser (1983: 5), therefore, state, "... syllabicity is not an intrinsic characteristic of segments but rather involves the relationship between a segment and its neighbours on either side" and they introduce an intermediate tier, called the CV-tier, in addition to the syllable tier and the segmental tier. Thus their syllable structure could be called the 'three tiered' model. The syllable structure held by Clements and Keyser is shown in (7), in which the hypothetical words [pa:] and [pa:p] are diagrammed.

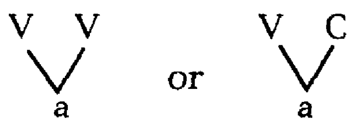
(7)

a. [pa:] b. [pa:p]

(Clements and Keyser 1983: 19)

The CV-tier functions: (i) as a mediator between the syllable tier and the segmental tier; (ii) as defining functional positions, i.e., it indicates the feature [syllabic] - the element C indicates [-syll], which is non-peak, whereas the element V indicates [+syll], which is peak; and (iii) as a timing unit, for example, in the case of long vowels or consonants, a single segmental matrix is linked to two slots on the CV-tier. With respect to the representation of long vowels, Clements and Keyser state that one segment is associated with two slots, either VC or VV, which depends on language-specific considerations. Diagrams are in (8).

(8)

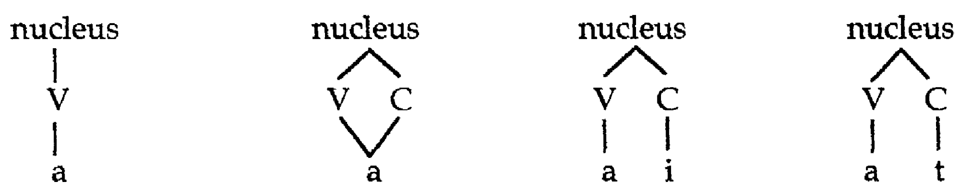


(Clements and Keyser 1983: 12)

Clements and Keyser distinguish a light syllable from a heavy one in terms of the category 'nucleus'. They state that a light syllable contains a 'simple' nucleus, which is non-branching, while a heavy syllable contains a 'complex' nucleus, which is branching. I reproduce their diagrams (1983: 13) for light and heavy syllables below.[10]

(9)

a. simple nucleus b. complex nuclei



Since the nucleus is not a subconstituent of their syllable structure, Clements and Keyser (1983: 17) have to present 'nucleus' on a separate plane. Consequently, they need to posit two types of representation; one is a 'three-tiered syllable display', as in (7), and the other is a 'three-tiered nucleus display', as in (9). The distinction of syllable weight does seem to be handled in CV phonology, however, it is not straightforwardly presented.

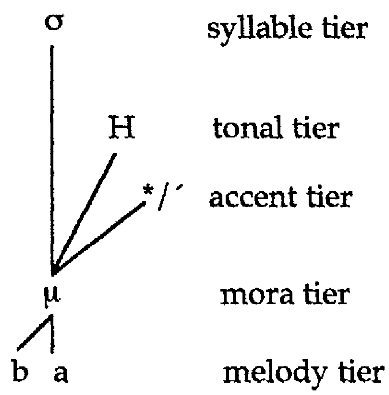
2. 1. 2. 3 Moraic theory

As in CV phonology, the representation of syllable structure within the moraic theory employed here also does not have an internal hierarchical structure. It

[10] In (9b), two V's associated with one segment is surely another option, as can be seen in (8).

contains the syllable tier, the mora tier, and the melody tier. Moraic theory is autosegmental in nature and may contain certain other autosegmental tiers such as a tonal tier, an accent tier and so on. The overall image of representation may be depicted as in (10). As has been mentioned in 2.1.1.2 (fn 4), the diacritics * and ´ represent respectively 'pitch/non-stress accent' and 'stress accent' in this thesis.

(10)



The mora tier represents phonological weight and has three functions: (i) as a mediator for other autosegmental and segmental tiers - as the CV-tier does in Clements and Keyser's model; (ii) as a measure of length, which the CV-tier also performs; (iii) as a 'prosodic licenser' - a function which is not discussed explicitly in Hyman (1985). I shall take up this matter in a later section.

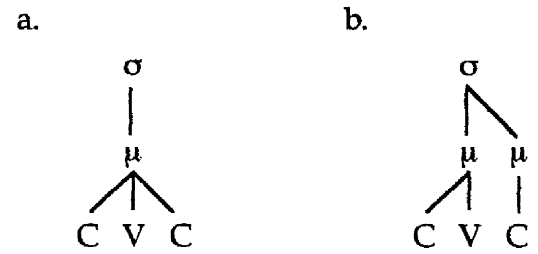
Function (i), as diagrammed in (10), shows that elements on the tonal tier are associated with morae; as are those on an accent tier (if present), and a syllable tier as well as the segmental melody tier, where melodic segments such as *b* or *a* associate with the 'core' mora tier. Function (ii) is illustrated in (11) below, in which the number of morae to which a single melodic segment is linked indicate length. This is exemplified here with the vowel *a*. The diagram (11a) indicates a short vowel whereas (11b) indicates a long vowel.

(11)

a. b.

In the syllable structure recognized within the current theory, unlike the branching syllable model, which contains distinct constituents (onset, rhyme, nucleus, and coda), the onset-rhyme opposition is not found. This is because the mora is the only constituent and the mora tier is directly dominated by a syllable node as can be seen in (12).

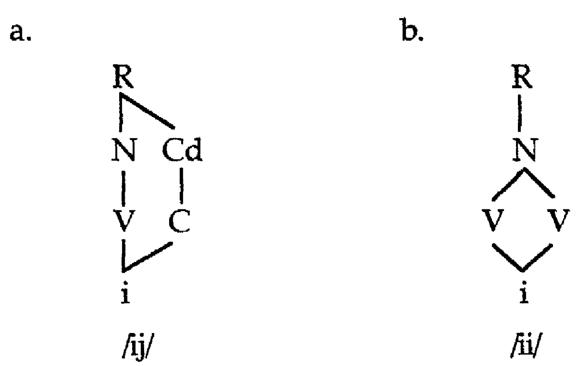
(12)



The branching rhyme depicted as in (5), corresponding to both (12a) and (12b), is non-distinct with respect to weight phenomena. However, the diagrams in (12) clearly show that the number of morae in a syllable make a syllable light or heavy: a light syllable consists of one mora while a heavy syllable consists of two, as in (12a) and (12b) respectively.

To sum up, the representation of syllable structure in the moraic theory this thesis employs dispenses with the notion of rhyme and nucleus, on which most versions of the non-linear approach rely in order to express the distinction between light and heavy syllables. However, in the moraic model, the distinction of light and heavy syllables can be seen in a most transparent manner. The number of morae in a syllable clearly distinguishes a light syllable from a heavy syllable. Furthermore, we could point out the indeterminacy in most versions of non-linear theories as to where any segment following the first vowel segment belongs; e.g., is [iː] syllabified as in (13a) or (13b)?[11]

(13)



[11] A generalized syllable structure is employed here, since whether or not use of the nucleus or the coda node is made depends on the author.

2. 1. 3 The Syllable Inventories of KiMvita and Japanese

Both KiMvita and Japanese are categorized as predominantly CV languages; i.e., languages in which most syllables end in a vowel. However, in KiMvita, a CVC syllable might be required for words of foreign origin and there are also pre-consonantal nasals (see below). In Japanese, the exception to being entirely characterizable as a 'CV language' involves a moraic nasal and syllables ending in a component of a geminate consonant. For example, Japanese words containing a moraic nasal and a component of a geminate consonant are *hoN* 'book', *hoNdana* 'bookshelf', *totta* 'take - past tense', and so forth. However, words such as **Nho*, and **ttato* are never found in Japanese.

The syllable inventory of KiMvita is one of the research points in this thesis. However, for the present the following provisional syllable inventory may be set up on the basis of claims found in the literature so far: CV, CVV, CVC, and C. The last type is found, for example, in consonant-initial stems having noun prefixes, such as /m-/ or /N-/.[12] These syllable types are provisionally illustrated as unmarked ones in (14).

(14) Provisional syllable types

a.	CV	/la/	'eat'
b.	CVV	/kaa/	'a piece of charcoal'
		/bei/	'price'
c.	CVC	/kab.la/	'before'
d.	C	/m-/	'Cl. 1 and 3 sg. prefixes etc.'

Regarding the syllable type (14c), it must be said that the CVC syllable type rarely appears word finally, meaning that a word-final syllable almost always ends in a vowel, CV.[13] In a C1VC2C3V sequence, the treatment of C2 needs careful research, since there are at least two possible syllabifications for C2; either as a margin ('coda') consonant of the first syllable or as a component of an onset for the second syllable. The former case is found in words of Arabic origin as in the example (14c). If the latter is the case however, then a CCV syllable type will need to be included for the syllable inventory of KiMvita. We will come back to this issue in chapters 3 and 4, where there is exhaustive discussion of the inventory of syllable types and the treatment of

[12] See 3.2.2. for noun prefixes.

[13] As will be seen in chapter 3, although KiMvita very clearly prefers a CV syllable in word-final position, a CVC syllable optionally appears in word-final position, though it is very rare. In Standard Swahili, this option occurs more than in KiMvita.

Consonant+Glide and Nasal+Consonant sequences. The last syllable type listed in (14d) is included to cover moraic nasals. However, we will see in chapters 3 and 4 that I dispense with this syllable type in the moraic theory this thesis employs.

Next, a syllable inventory for Japanese is considered. In Modern Japanese, there are three different lexical sources: Old Japanese (or Yamato Japanese), Chinese adoptions, and loanwords from languages other than Chinese. The syllable inventory of Old Japanese consisted of only one type of syllable, (C)V (Vance 1987: 56). However, under the influence of Chinese loans, CVV, CVN and CVÇ types were added to the syllable inventory (Ç refers to a moraic obstruent, which is a moraic component of a geminate consonant, in Japanese). I shall cite some examples from Vance (1987: 57) to show the correspondences between modern Japanese and modern Cantonese in terms of pronunciation, which are shown in (15).[14, 15]

(15)

	Cantonese	Japanese	Gloss
a.	/meŋ/	/mei/	'name'
b.	/san/	/saN/	'mountain'
c.	/nam/	/naN/	'south'
d.	/tʰit + sin/	/tes + seN/	'iron wire'

The CVÇ type, as seen in (15d), is for a syllable containing a component of a geminate consonant,[16] and this syllable type may not appear word finally, although the CVN type may.

In addition, there is one further type of syllable, CVVN, which was introduced when words from mainly European languages were borrowed, for example, *saiN* 'sign', *raiN* 'line', etc.

Observation of the history of the syllable inventory of modern Japanese leads many phonologists (Poser 1984, Vance 1987, Shirota 1993, and Kubozono

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[14] In Japanese, the pronunciation of Chinese characters is in two ways; *kun-yomi (Jikun)* (Yamato Japanese pronunciation) and *on-yomi (JioN)* (modified Chinese pronunciation). In (15), the column for Japanese pronunciation is based on *on-yomi*. They are pronounced /yama/ for (15b), /minami/ for (15c), etc. in Yamato Japanese pronunciation.

[15] It is said that Cantonese includes six different varieties, and one of them is called 'Tang (dynasty) speech' (see Bauer and Benedict 1997: xxxi). Japanese borrowed Chinese at different times and in different areas; one of two major sources is believed to be the standard language of the Tang period (see Takamatsu 1982 and Shibatani 1987, among others). Thus similarities in terms of pronunciation could be found between the two languages.

[16] A component of a geminate consonant is traditionally represented using the notation Q, thus /teQ.seN/. However, I shall use the appropriate alphabetical segment instead of Q.

1995) to claim that the syllable inventory of Japanese consists of two classes; one is called the 'unmarked syllable type', and the other the 'marked syllable type'. The former consists of CV, CVV, CVN, and CVÇ, whereas the latter consists of CVVN for European loanwords. Furthermore CVVÇ and CVNÇ types, which occur in derived words resulting from compounding or suffixation, belong here. The syllable inventory and some examples are shown in (16) and (17), (where . indicates a syllable boundary).

(16) Unmarked syllable types

a.	CV	ko	'child'
b.	CVV	kai	'shellfish'
		suu	'number'
c.	CVN	moN	'gate'
d.	CVÇ	gak.ki	'musical instrument'

(17) Marked syllable types

a.	CVVN	meeN	'main'
		koiN	'coin'
b.	CVVÇ	toot.ta	'pass-past'
		hait.ta	'enter-past'
		to.kaik.ko	'urbanite'
		too.kyook.ko	'a person native to Tokyo'
c.	CVNÇ	roN.doNk.ko	'Londoner'

As can be seen from the examples in (16) and (17), the maximum number of morae per syllable is two in the unmarked syllable type, however, a super-heavy syllable type, containing three morae per syllable, exists in the Japanese marked syllable type inventory.

With respect to the initial consonant of each syllable type, two views are widely recognized. On the one hand, Poser (1984) and Vance (1987) hold that the onset is optional. On the other hand, McCawley (1968) and Haraguchi (1977) claim that a glottal stop appears in the onset position when a word begins with a vowel in terms of its orthography. My position is the latter one. I shall return to this matter in 2.4 concerning syllabification in the moraic theory this thesis employs.

In the following section, the maximum number of morae per syllable in unmarked syllable types is discussed.

2. 1. 4 Why is a Super-heavy Syllable a Marked Structure in Japanese?

As we have seen in the previous subsection, a trimoraic (super-heavy) syllable type exists in the Japanese syllable inventory. Hayes (1989: 291) claims that a syllable containing maximally two morae is the unmarked case; he adds, however, that trimoraic syllables are found in some languages. In the case of Japanese, it is said that a trimoraic syllable type is a marked case, unlike languages such as Hindi in which a trimoraic (super-heavy) syllable type as well as monomoraic and bimoraic syllables is commonly found; for example, *reez.gaa.rii* 'small change', *mu.sal.maan* 'Muslim', etc. (see Broselow, Chen, and Huffman, 1997: 49). Trimoraic syllables are also relatively common in certain languages of the Cushitic and Omotic language groups. For example, Gamo (see Hayward and Eshetu Chabo in preparation), which belongs to the Omotic language family and is spoken in Ethiopia, contains an abundance of words involving trimoraic syllables such as *tʃ'ooŋ.gi* 'chewing', *muuts'.ts'o* 'to suck' *ts'uuts.tsi* 'blood' and so on. Then we may ask why a super-heavy syllable should be considered such a marked case in Japanese. I shall draw two pieces of evidence from Japanese itself and adduce further support from Saho-Qafar, which is one of the Cushitic language groups that does not allow trimoraic syllables (see Hayward, 1997).

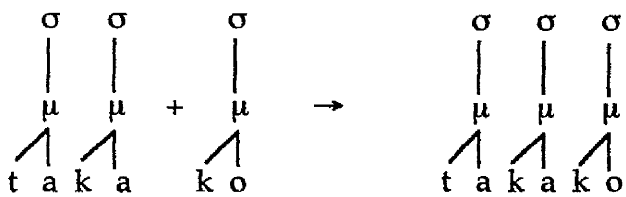
2. 1. 4. 1. Japanese anthroponymic pairs

To begin with, I discuss the phenomenon of Japanese anthroponymic pairs. Many Japanese names consist of three 'syllabary letters', though there are, of course, also names consisting of two or four syllabary letters. I focus only on common three syllabary letter names here. In the common type of Japanese female names, *ko* is found at the end of the name, as in: *Mitsuko, Takako, Yuuko, Mieko,* etc. In the male counterparts, *o* is found as the last syllabary letter of such names, as in: *Mitsuo, Takao,* and so on. What is interesting to see here is that *Mitsuko* and *Takako* are paired with *Mitsuo* and *Takao* respectively. *Yuuko* and *Mieko,* however, lack male name counterparts, which might be supposed to be **Yuuo,* and **Mieo*. I shall consider why the first two female names do have male counterparts, but the last pairs do not.

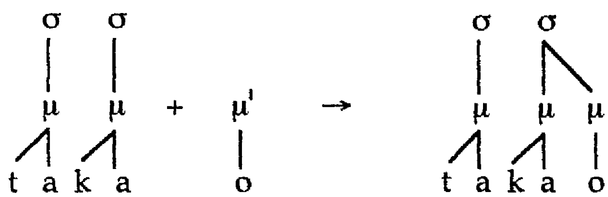
In order to analyze this phenomenon, two hypotheses could be considered: (i) *ko* and *o* are analyzed as independent suffixes, (ii) male names are derived from female names in consequence of *k* being deleted.

According to the first hypothesis, the structures of *Takako* and *Takao* would be as displayed in (18). It should be noted here that in the version of moraic theory this thesis employs, the mora which does not satisfy the condition for constituting a syllable, which will be discussed in 2.4.1, is diagrammed as μ'. Such a notation indicates it is an unsyllabified mora. This convention is employed throughout this thesis.

(18) a. Takako



b. Takako



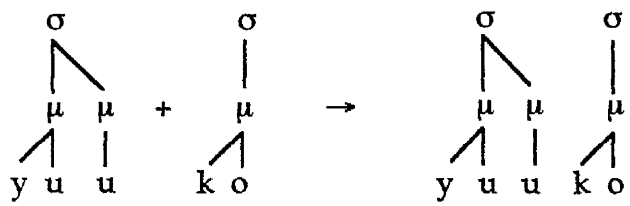
As can be seen in (18), the common stem of the female and male names is *taka*, and suffixation of *-ko* and *-o* takes place. In the case of the female name, *-ko* is simply added and no resyllabification is required, while in the case of the male name, the suffix-*o* , which is unsyllabified on its own before the derivation, is syllabified into the preceding syllable and as a result the male name suffix *-o* is realized as the second mora of the syllable.

Before considering unmatched paired names, it is necessary to provide the representation of a long vowel. As in the case of KiMvita (see 4.2.2.3.2), the association of two segmental matrices with distinct morae is also claimed for a long vowel in Japanese. A language game, called the *babibu* language played among teenagers, could provide a piece of evidence for a long vowel being represented with such a syllable structure. According to my informant, the game proceeds by insertion of a syllable letter either *ba*, *bi*, *bu*, *be*, or *bo* to a preceding mora according to a vowel with which such a mora is associated. For example, *sakura* 'cherry blossom' becomes *sa-ba-ku-bu-ra-ba*. When a word contains a long vowel, it is separated by two inserted syllables; e.g., *okaasaN* 'mother' becomes *o-bo-ka-ba-a-ba-sa-ba-N-bu*.[17]

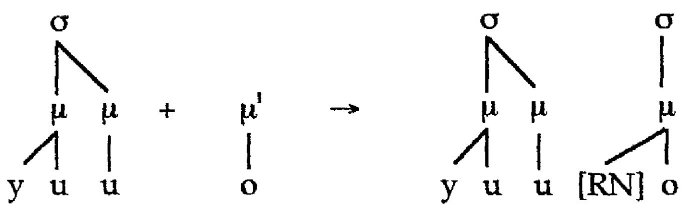
[17] A syllable letter *bu* is inserted after an *N*. My thanks to Nagako Oyabu, who provided these examples.

The representations of the female name *Yuuko* and its corresponding (but non-existent) male name **Yuuo* would be as in (19).

(19) a. Yuuko



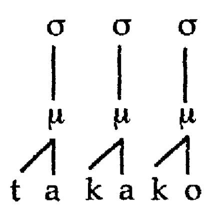
b. *Yuuo

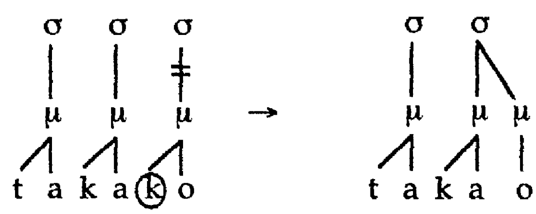


(19a) demonstrates the case of female name, to which the same explanation is given as in (18a). In the case of the male name, the vowel-initial male name suffix could obtain a root node as an onset to the suffix *-o*.[18] However, although this syllabification includes only acceptable syllable types of the Japanese syllable inventory, it would allow the male name **Yuuo* to exist - which is contrary to the fact. Thus, this hypothesis is rejected.

I shall investigate the second hypothesis, which is that male names are derived from female ones: in a process in which *k* in *ko* just delinks from the mora. Consider the following structures for *Takako* vs. *Takao*, and *Yuuko* vs. **Yuuo* in (20) and (21) respectively (where a circle, in this case around *k*, indicates an element to be deleted).

(20) a. Takako b. Takao





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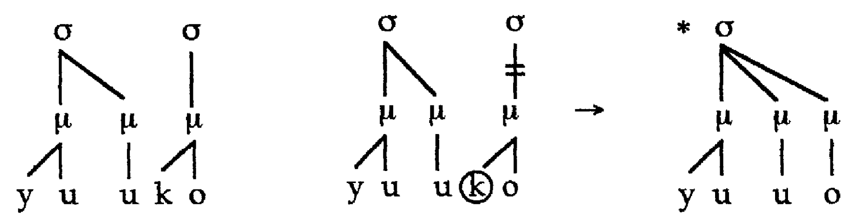
[18] Full discussion of a root node epenthesis will be undertaken in section 5.3.2.2.2.

(21) a. Yuuko b. *Yuuo



After the removal of *k* in (20b), *o* itself cannot constitute a syllable, and consequently *o* is incorporated into the preceding syllable and forms a bimoraic syllable. In following the same procedure in (21b), however, resyllabification of *o* is not triggered, since if it were the case, we would have to admit Japanese syllables containing three morae and the form *Yuuo* ought to be widely attested in Japanese as a male name, which is contrary to the fact.

To sum up, the 'deletion hypothesis' correctly predicts the non-attestation of male names which might contain an unpreferred trimoraic syllable type; while on the other hand, the 'suffix hypothesis' provides an incorrect output although it generates only a preferred syllabification. This discussion of Japanese anthroponymic pairs concludes that Japanese traditional three syllabary male names are phonologically derived from female name counterparts, and supports the view that Japanese phonology generally rejects a trimoraic (super-heavy) type of syllable. Non-anthroponymic pairs are found not only in the case of *Yuuko* and *Mieko*, but also in some other female names such as *Kyooko*, *Keeko*, *Maiko*, *Rieko*, and so forth: I have found at least thirty female names that lack male name counterparts.[19] Thus the investigation of Japanese anthroponymic pares of names is one piece of evidence which shows that a syllable containing more than two morae is not liked in Japanese. The second piece of evidence is related to loanwords and is discussed in the following subsection.

2. 1. 4. 2 Assimilation of loanwords into Japanese

In recent decades the number of borrowed words in Japanese has increased dramatically: about six thousand loanwords are recognised in a middle-sized dictionary that contains about sixty thousand items of vocabulary. Not only do phonetic adaptations, such as [vjuː] 'view' becoming [bjuː] occur but phonological adaptations have also to be recognized when loanwords are used

[19] I have found only one exception within anthroponymic pairs, which is *Reeko* and *Reeo*. However, the male name *Reeo* is not very common.

by native Japanese speakers. For example, since consonant clusters are not permitted unless they appear as a geminate consonants, vowel epenthesis is always employed, e.g. milk - *miruku*.

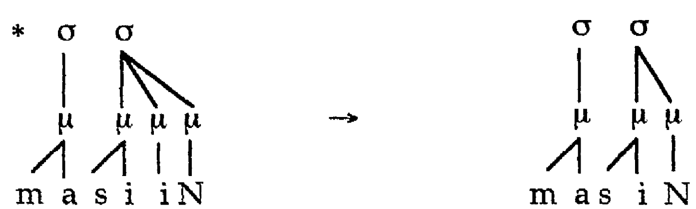
Adaptation to Japanese mora structure is another factor, in which the number of morae per syllable is reduced to two in Japanese pronunciation if there are three morae in the source word. This is especially the case when either a long vowel or a diphthong is followed by a nasal consonant in the source language (Kubozono 1995: 21). Examples are listed below.

(22)

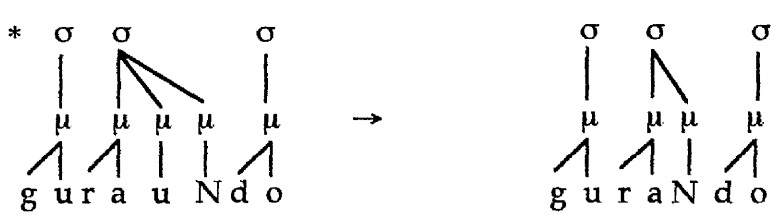
a.	/məʃiːn/	*masiiN	→	masiN	'machine'
b.	/graund/	*gurauNdo	→	guraNdo	'ground'
c.	/eɪndʒəl/	*eiNjeru	→	eNjeru	'angel'

In (22), the words in the second column contain three morae per syllable, as diagrammed in (23a, b), and would be as close to the original pronunciation as possible. As a matter of fact, the pronunciations in the third column are normally used in order that the Japanese syllable structure is maintained, as depicted in (23a', b').

(23) a. masiiN a'. masiN



b. gurauNdo b'. guraNdo



In sum, preference for bimoraic syllables over trimoraic ones in Japanese is seen in the avoidance of a trimoraic syllable type when loanwords are adapted into Japanese phonology.

2. 1. 4. 3 Supporting evidence from Saho-Qafar

Languages of the Saho-Qafar group, which belong to the Cushitic language family, and are spoken in Ethiopia and Eritrea also show that their phonology only allows a syllable to dominate two morae maximally. Therefore, when three morae might appear successively in a word-internal position, they undergo some phonological operation which reduces the number of morae in a syllable so that the maximum permitted number of morae per syllable is achieved.

Hayward (1997) discusses the 'long vowel contraction process' (hereafter LVCP), which manifests itself in an alternation in some morphemes where the same vowel appears long in an open syllable but short in a closed one. The LVCP is triggered when a syllabification problem appears. An instance comes from the so-called Suffix Conjugation of verbs, in which the stem vowels are affected by the LVCP. For example, when a vowel-initial suffix is affixed to a stem, the stem vowel stays in an open syllable; conversely, the LVCP operates when a consonant-initial suffix is applied to a stem. Examples are displayed in (24), where 3, 2, m., f., sg., and pl. indicate 3rd person, 2nd person, masculine, feminine, singular and plural respectively.

(24)

perfect		imperative		
3 m. sg.	3 f. sg.	2 sg.	2 pl.	
faak-e	fak-te	fak	faak-a	'open'
deer-e	der-te	der	deer-a	'cry out'
ɖiin-e	ɖin-te	ɖin	ɖiin-a	'sleep'
oob-e	ob-te	ob	oob-a	'descend'
laħuut-e	laħut-te	laħut	laħuut-a	' become sick'

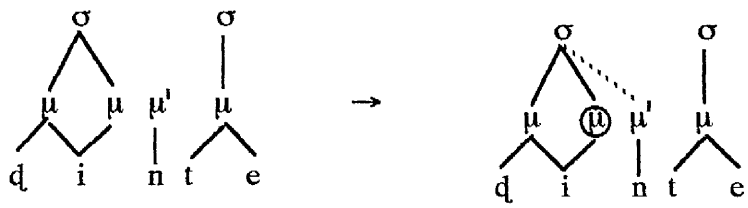
(Hayward 1997: 58-59)

A vowel-initial suffix is seen in the 3 m. sg. perfect and the 2 pl. imperative. On the other hand, a consonant-initial suffix is found in the 3 f. sg. perfect, and the 2 sg. imperative does not take a suffix, so that the stem-final consonant comes word-finally. The LVCP takes place in the latter two cases.[20]

The mechanism of the LVCP is demonstrated in (25), where μ' indicates an unsyllabified mora.

[20] See full argument in Hayward (1997).

(25) ḍin-te



(Hayward 1997: 61)

The vowel /ii/ in *ḍiin-e*, the 3.m.sg perfect, appears short in the 3s.f.sg perfect as *ḍin-te*, which is the outcome of the LVCP; i.e., that the stem vowel *i* is contracted in order that an unsyllabified mora dominating *n* is able to be syllabified. In Saho, both (C)VV and (C)VC are treated as heavy syllables, since Saho phonology does not allow the Margin Creation Rule; nor do trimoraic syllables exist. The maximum number of two morae per syllable is strictly observed in Saho.

2. 2 The Concept of Syllabification

2. 2. 1 Are Syllables Derived or Underlying in the Lexicon?

Most phonological theories claim that syllables are created as a result of syllabification. In other words, syllables are derived by rules or conditions while segments are underlyingly present in phonological structure. On the other hand, in a theory such as Government Phonology (hereafter GP) as advocated by Kaye, Lowenstamm and Vergnaud (1985, 1990), a syllable appears to exist underlyingly. In fact, there is no syllable node as such found in a phonological structure in GP, nevertheless, a string of Onset and Rhyme pairs implies the existence of syllable structures underlyingly.

Moraic theory also holds the former concept, i.e., that syllables are derived. On the basis of Blevins's (1996) discussion, I shall outline three points concerning syllables which suggest that they are created by rules and/or conditions.

The first point is that it is rare that the same melody sequence is distinguishable by syllabification alone in any language. In English, for example, the /ai/ sequence is generally treated as heteromorphemic, and normally forms a complex nucleus. This case is found in words such as *I* [ai], *kite* [kait], *tile* [tail] and so on. On the other hand, the /ai/ sequence in a word such as *Aïda* does not form a complex nucleus but is syllabified into distinct syllables, [ʔa.íy.da]. Blevins (1996: 221) discusses this point as follows; "... we can assume that minimal structure is specified in the lexicon. ... it is sufficient to mark /i/ as a syllable nucleus in the UR; /a[i]$_N$da/ ...". She concludes that this underlying syllable structure will prevent an /ai/ sequence from being syllabified as a complex nucleus. However, we could assume that such a structure is a marked case.

The second point justifying a syllable being thought of as a result of derivation concerns syllabicity alternations. Many studies report that syllabicity alternations are a consequence of regular syllabification process. Among these studies,[21] Dell and Elmedlaoui's (1985) study for Imdlawn Tashlhiyt Berber is worthy of remark. They report that in Imdlawn Tashlhiyt Berber, syllabic vs. non-syllabic allophones are found for all segments except for a low vowel *a*, which always surfaces as a vowel. Therefore, a simple syllabification algorithm which predicts that syllabicity of a segment is applied to a string of unsyllabified underlying segments.

The last point relates to segments which fail to satisfy the conditions governing the syllable types of the language in question. This often happens in the case of underlying and intermediate representations, in which those segments are treated either as extrasyllabic (until the surface structure) or as stray segments. As a consequence, in the former case it is incorporated into a syllable on the surface structure, while in the case of a stray segment it is deleted in the course of the derivation. These facts are enough to suggest that syllables are derived as a result of a syllabification algorithm.

2. 2. 2 Exhaustive Syllabification and Partial Syllabification

Many approaches in syllabification, regardless of whether they are rule-based or template-matching, follow the concept of exhaustivity. Exhaustive syllabification concerns so-called extrasyllabic segments or 'appendices', which are generally regarded as irrelevant parts of syllables as far as phonological phenomena are concerned. In the process of syllabification, these segments will

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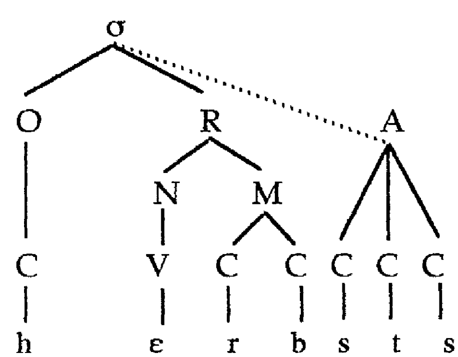
[21] Steriade (1982) for Latin and Ancient Greek, Noske (1982) for French, Sagey (1986) for Kinyarwanda, Guerssel (1986) for Ait Seghrouchen Berber, Steriade (1984) for Rumanian, Levin (1985) for Klamath (see Blevins (1996) for references), and Hayward (1988) for Amharic and Chaha.

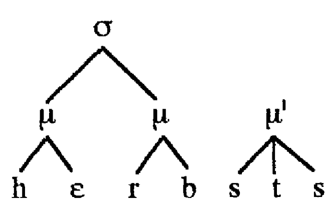
be syllabified at the very end of the cycle, and consequently, they are incorporated into a surface syllable structure.

However, Hyman (1985: 52) discusses extrasyllabic segments (that would be treated as appendices by some non-linear phonologists) which are, in fact, not necessary to be syllabified. In other words, Hyman seems not to believe that the appendix with which extrasyllabic segments are associated would necessarily be a constituent of a syllable - as, for example, in Halle and Vergnaud's (1980) syllable structure - and he suggests partial syllabification, i.e., a mora with which certain segments are associated is not linked to a syllable. Thus according to Hyman, such segments only share a single mora,[22] but are not syllabified. Hyman (op.cit.: 53) concludes, "What makes the extrasyllabic hypothesis attractive ... is that syllable structure is still preserved". The two different types of syllabification for extrasyllabic segments, for example the German word *(des) Herbsts* '(of the) autumn', would be represented as in (26); (26a) according to Halle and Vergnaud, and (26b) according to Hyman.

(26) a.



b.



(Hyman 1985: 52)
(μ' indicates an unsyllabified mora)

[22] This is applicable only for word-final segments. Regarding word-initial/-internal segments, they do not necessarily share one mora but retain their own mora, since they might be involved in phonological phenomena, such as will be discussed in 4.2.2.2.

In addition, there is another type of unsyllabified mora, i.e., a mora associated with a vowel which lacks an onset segment. Such a mora may not constitute a syllable on its own, otherwise it would be an onsetless syllable. The non-syllabification of onsetless vowels is an important claim in Hyman's work. This will be discussed in the Least Syllable Condition in 2.4.1.

2. 2. 3 Resyllabification

It is generally said that a /...V_1CV_2.../ sequence where a grammatical boundary appears between C and V_2 becomes a target for resyllabification. Then, what induces resyllabification? Two types of resyllabification could be envisaged.

The first type of resyllabification, which normally takes place in the post-lexical or the phrasal phonology, operates to avoid an onsetless syllable. This is schematically shown as follows; a /... C.V.../string becomes /... .CV... /. Illustrative examples are found in Spanish, French, and German.

In both Spanish and French, that an onset consonant originally appears at a word boundary is very common. For example, the French word *cet ami* 'this friend' is resyllabified as *ce.ta.mi.* This kind of resyllabification is also seen in Spanish: *Los otoros estaban en el avion* 'The others were on the airplane' is resyllabified as Lo.s o.tro.s es.ta.ba.n e.ne.l a.vion (Harris 1983). Another type of resyllabification in connection with phonetic realization of a target segment is also found in Spanish. Harris (op. cit.) observes that a trilled /r/ is realized when it appears in a 'coda' position in emphatic speech. Thus *r* in *mar* 'sea' may be pronounced as a trilled *r* in highly emphatic speech. When the word *mar* is followed by a consonant-initial word, variant forms arise; plain /r/ (presumably a tap) and trilled /r/. However, when it is followed by a vowel-initial word, no alternation is realized, i.e., there is only a plain (tap) /r/, since it becomes an onset consonant for the following syllable. Thus in *ma[ɾ~r̃].verde* 'green sea', *r* is syllabified as a coda while *r* in *ma.[ɾ]a.zul* 'blue sea' is syllabified as an onset. Devoicing in German provides a further example. In German, an obstruent consonant in a 'coda' position appears to be devoiced, for example, *Kind* → *Kin[t]* 'child', *Tag* → *Ta[k]* 'day', and so on. These devoiced consonants become voiced when a vowel-initial suffix is added to them, which is also motivated in order to avoid an onsetless syllable. Hence, *kin* [d]-*ish* 'childish' and *Ta* [g]-*e* 'days'. In all four cases, a variety of phonological phenomena show that 'coda' consonants become onset consonants by resyllabification so that an onsetless syllable is avoided.

The second type of resyllabification could arise on the basis of pitch accent assignment under a recent analysis in Japanese.[23] It is generally accepted that the accent may not be borne by the second mora of a syllable in Japanese. Thus, if accent is assigned to the second mora, it shifts to its left. However, in a compound such as *roNdoN* + *kko* → *roN.doNk.ko* 'Londoner' (where . indicates syllable boundary), such accent shift does not occur and as a consequence the second *N* bears accent. Traditionally, a *doNk* syllable would be syllabified into a trimoraic (super-heavy) syllable, which inevitably violates the constraint on the accent bearer. However, a recent analysis claims that such a sequence is best analyzed as consisting of two syllables, a monomoraic (light) and a bimoraic (heavy) syllables. Hence, a trimoraic syllable is resyllabified into two distinctive syllables; thus *roN.doNk.ko* → *roN.do.Nk.ko.* [24]

2. 3 Previous Studies on Syllabification

Any procedure of syllabification requires combination of rules, conditions and principles, regardless of the particular type of syllabification algorithm. Two distinct syllabification approaches have been found in the literature so far. One is the rule-based approach advocated by Kahn (1976), Lowenstamm (1981), Cairns and Feinstein (1982), Steriade (1982), and Levin (1985), among others. The other, held by Halle and Vergnaud (1978), Selkirk (1982), Noske (1982, 1988), and Itô (1986, 1989), among others, is called the templatic approach. Each approach will be sketched out in separate sections. Following these, the moraic approach will be looked at. The basic concept of syllabification within the moraic theory employed here, which may be termed a 'hybrid' approach, will be dealt with in 2.4.

2. 3. 1 The Rule-based Approach

There is one assumption shared in this approach by all the authors, which is seen in Steriade's (1982: 74) statement; "... the entire string is organized into

[23] There is another example for resyllabification induced by stress assignment. Blevins (1996) points out Borowsky's (1986 [in Blevins *ibid.*]) work, in which a stress-conditioned resyllabification rule in English causes flapping, *h*-deletion, *y*-deletion, and palatalization.

[24] Syllabification of such a compound under the current theory does not involve resyllabification (see 5.3.3.2).

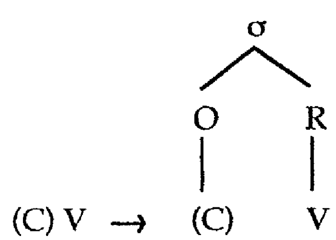
syllables in one scan (or one scan per cycle)". However, rules vary among the authors, for example, Lowenstamm (1981) exploits the sonority hierarchy to define the universal syllable template in which the concept of 'onset maximization' is apparent. Cairns and Feinstein (1982), on the other hand, see a syllable template as a language-specific object, and after parsing a string use markedness conditions to select a preferable syllable from 'the candidate set'. Nonetheless, the following three generalizations can be made.[25]

(27)

a. Link a [-consonantal] segment to a syllable node.
b. Link a sequence of [+consonantal] segments, which is a permissible syllable-initial cluster, to the syllable node which already dominates the [-consonantal] segment.
c. Link a sequence of [+consonantal] segments, which is a permissible syllable-final cluster, to the syllable node which already dominates the [-consonantal] segments.

Here I shall outline the basic rules for syllabification in Steriade's theory, which represents a slightly modified version of Kahn's (1976) theory. Steriade (1982: 78) proposes, "... maximally unmarked CV syllables are created by a universal first rule in the sequence of syllabification operations". Thus, the first rule is designed for all inter-vocalic consonants, which become onsets before language-specific rules are taken into consideration so that codas can be created. The first rule is depicted in (28).[26]

(28)



(Steriade 1982: 78)

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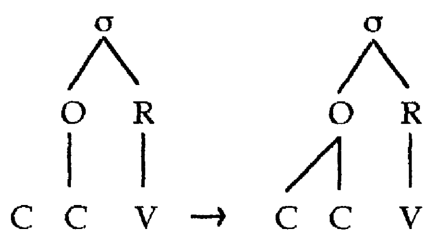
[25] See also Noske (1992: 29).

[26] Steriade does not give a specific name for this 'universal first rule', which seems to express the same concept as an onset rule employed by other authors. She employs the name 'the Onset Rule' for creating onset clusters. This latter rule seems to be equivalent to the Onset Adjunction Rule in the moraic theory this study employs(see 2.4.3.1). Furthermore, the Coda Rule in Steriade's theory can deal with creating both 'a single segment' coda and coda clusters.

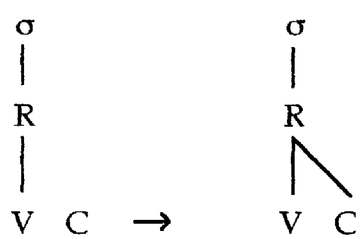
Steriade's syllable structure consists of a rhyme and an onset. In the procedure of syllable scanning, a vocalic segment is associated with a rhyme node while a consonantal segment is linked to an onset node. The association of a consonantal segment to an onset node takes place before language-specific rules creating codas may become applicable. Thus in accordance with the rule (28), a VCV sequence is syllabified as V.CV.

A language-specific syllable structure could create complex onsets and/or branching codas, which are created by the following rules.

(29) a. Onset Rule



b. Coda Rule

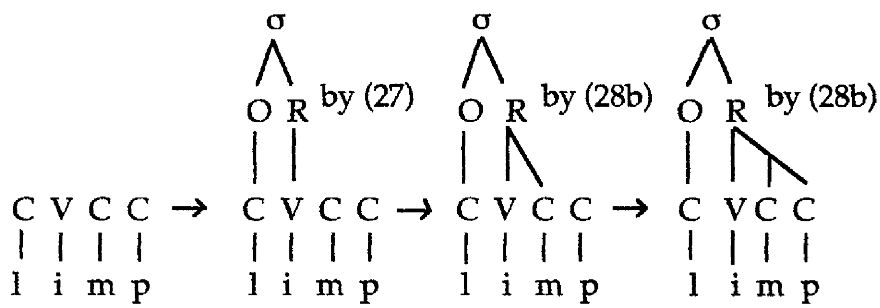


(Steriade 1982: 78-79)

The rule (29a) derives a branching onset while the rule (29b) creates a coda. As in Steriade's statement below, if there are two post-vocalic segments the Coda Rule applies twice. Because of the language-specific nature of these rules a language may lack (29a) or (29b), or both.

Steriade terms the rules in (28) and (29) the core syllable rules, thereby adopting the Clements and Keyser's (1981) concept, 'core syllable', and she (1982: 79) assumes that all three rules are iterative in the following two senses: (i) each rule iterates across the string until it covers all sequences to which it is applicable; (ii) when possible the rules iterate on their own output in creating larger constituents. Thus, if the grammar of a language allows a consonant cluster in codas, a string of segments like CVCC may require two applications of rule (29b). For example, an English word such as *limp* will follow the procedure diagrammed in (30).

(30)

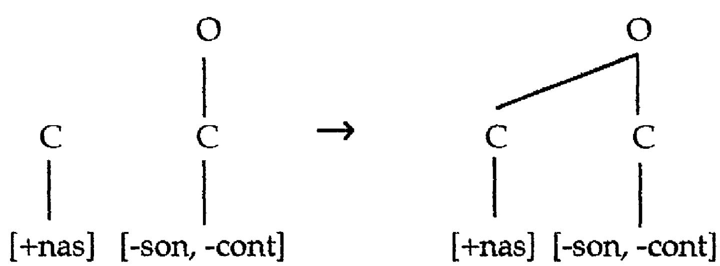


(Steriade 1982: 80)

As can be seen in (30), two successive operations create a complex coda; the 'right branching structure' in Steriade's terms.[27] In order to create a complex coda there must also be a constraint on segment combinations, which is omitted in the discussion here.

Likewise a permissible onset cluster would be created by the rule (29a), again with specification of conditions on segment combinations. For example, Sinhala permits the nasal-stop onset clusters, which may be stated in a rule such as the Sinhala Onset Rule depicted in (31).

(31) Sinhala Onset Rule: ordered before the Coda Rule



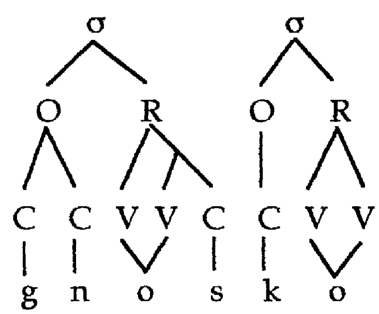
(Steriade 1982: 83)

Within this rule-based approach, if the syllable structure of the language in question contains certain clusters, it will be generated by just one rule only. These are the conceptual characteristics of rule-based syllabification, unlike the templatic approach which stipulates a language-specific 'syllable template' and an 'unambiguous statement' (Steriade, op.cit.: 83). What is necessary for a NC sequence to be syllabified in Sinhala is a rule such as that of (31). Since this rule is applied before the Coda rule, a sequence such as VNCV will be syllabified as V.NCV.

[27] Although the last diagram in (30) shows an unlabelled branching node under the Rhyme node, the status of this unlabelled node is unclear. However, for Steriade, the terms nucleus and coda are not constituents in her syllable structure, but simply convenient labels.

With respect to a long vowel or a vowel sequence which is not followed by a coda consonant, I assume that two vocalic segments could be associated with a branching rhyme, although Steriade does not demonstrate a procedure for this kind of syllabification explicitly. In the case of two vocalic segments followed by a coda consonant, the right branching rhyme could be a solution. Steriade, in fact, syllabifies the Greek word *gnosko,* containing two long vowels *o,* as in (32).[28] One is followed by a coda consonant, and the other is not. In the former case, an unlabelled branching node under the Rhyme, as already pointed out in (30), is found, while a branching rhyme is posited in the latter case.

(32)



(Steriade 1982: 302)

To sum up Steriade's rule-based syllabification, the universal rule (28) and the language-specific rules (29) are the core syllable rules for syllabification. The ordering of these rules is a point of vital importance. Steriade (op. cit.: 79) states that on the one hand, in English (as well as Sinhala above) the Onset rule is ordered first, on the other hand, the Coda rule is applied prior to the Onset rule in languages such as Klamath. As we have already noted, the core rules are iterative, thus all permissible segments are syllabified by iterative application of the rules. Constraints on permissible segment sequences are based on the sonority hierarchy of the language in question.[29]

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[28] The syllabification of the first two consonant clusters is focused on in her discussion. Steriade demonstrates four alternatives for the initial consonant cluster. I here, cite one of them, in which they are treated as a complex onset cluster.

[29] For example, Steriade (1982: 98) proposes language-specific sonority scales for Latin and Greek.

2. 3. 2 The Templatic Approach

In general, the templatic approach could be characterized as a mapping procedure taking place between a string of segments and a syllable template, which functions as a well-formedness condition. Other well-formedness conditions are also applicable to a syllable template. In this section, we will look at Itô's (1986, 1989) approach.

Itô (1986: 2) views a syllable theory as an integral part of Prosodic Phonology and a conception of syllabification as continuous template matching governed by syllable well-formedness conditions and directional parameters. Thus she proposes the following three basic principles of Prosodic Phonology (Itô *ibid*.).

I. Prosodic Licensing
All phonological units must be prosodically licensed (modulo extraprosodicity).

II. Locality
Well-formedness of a prosodic structure is determined locally.

III. Directionality
Phonological mapping proceeds directionally; left-to-right or right-to-left.

Prosodic Licensing says that segments must belong to syllables; syllables must belong to metrical feet; metrical feet must belong to phonological words or phrases. Locality concerns the well-formedness of a syllable, which is determined by information within the syllable structure. Cooccurence constraints, which seem to rely on both universal and language-specific sonority scales, are applicable locally. Regarding the third point, Itô (op. cit.: 10) states, "... directionality plays an explanatory role in syllable theory ... the directionality parameter makes it possible to map intervocalic consonants to the template in an unambiguous way". The right-to-left mapping suggests onset maximization which is seen in most Indo-European languages, while coda maximization is triggered by the left-to-right mapping as seen in Klamath and Icelandic.

There are two more strategies needed in order to satisfy Prosodic Licensing, namely, Extraprosodicity (abbreviated to Ex.) and Stray Erasure (hereafter SE).[30] The former allows edge segments to be prosodically licensed, and elimination of unlicensed segments is triggered by the latter. For example, words in Diola Fogny exhibit these two. The Diola words *u-juk-ja* 'if you see' and *kuñilak* 'the children' are realized as [ujuja] and [kuñilak] respectively. The syllable template and Coda Condition of Diola Fogny are shown in (33). Syllabification of the two words is illustrated in (34). Regarding syllable structure, Itô adopts the representation proposed by Clements and Keyser (1983), which contains no internal hierarchical structure.

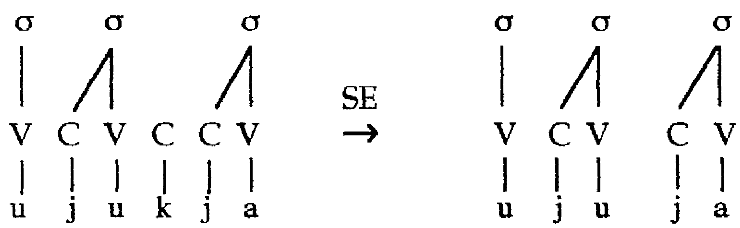
(33) a. Diola Fogny Syllable Template: [CVVC]

b. Diola Fogny Coda Condition: *C]$_\sigma$
|
[+cons]

(Itô 1986: 60, 61)

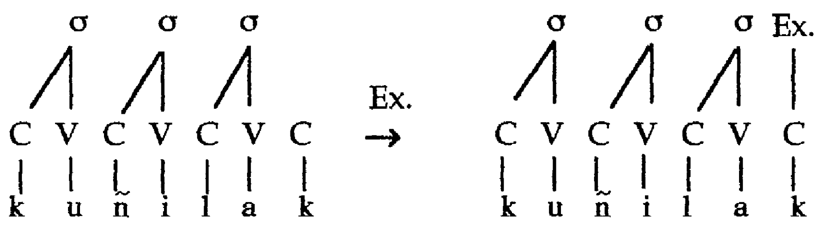
With regard to coda consonants, (33a) and (33b) seem to contradict each other. Itô (1986: 61) explains this contradiction as follows: "... the loss of the medial *k* (in a sequence of *u-juk-ja*) under Stray Erasure, the consonant must be blocked from being syllabified as a coda". However, Itô (1986: 61 fn 3) considers the existence of geminates and assimilated clusters in Diola Fogny, for example, *ni.nen.nen* 'I placed', and *e.kum.bay* 'the pig', etc., as overt evidence for the existence of a coda and such forms cannot be analyzed with a codaless template.

(34) a. u-juk-ja → ujuja by Stray Erasure



[30] Stray Erasure is one of several dynamic phonological processes utilized in many languages such as Korean (Kim and Shibatani 1976), Attic Greek (Steriade 1982), Icelandic (Itô 1986), Lardil (Wilkinson 1988) and so on. See Itô (1986) for references.

b. kuñilak → kuñilak by Extraprosodicity



(Itô 1986: 62)

Itô (1986: 49) suggests two central assumptions for continuous syllabification theory as in (35).

(35)

a. Language-specific syllabification conditions are stated in terms of well-formedness conditions.
b. Syllabification is not performed by a set of language-specific rules but by the universal association mechanism (which includes initial association as well as reassociation and dissociation).

Pesetsky (1979) proposes that if phonological rules appear at two distinct points in the grammar: one in the lexicon and the other in the postsyntactic phonological component, syllabification rules should also take place at two different stages. Following Pesetsky, Kiparsky (1982a) demonstrates that rules which are applicable in the lexical phonology need not hold in the post-lexical phonology.[31] This idea is formulated as the Principle of Structure Preservation (henceforth SP), which is also considered as another essential constraint on the continuous nature of syllabification. Itô adopts Kiparsky's (1982a) concept of SP, which is given in (36).[32]

(36) Structure Preservation

A well-formedness constraint may not be violated during the lexical phonology.

Following the Principle of Structure Preservation, in Itô's templatic approach, SP is strictly respected in the lexical phonology but not in the post-lexical phonology. Here we shall see the interaction of SP, Ex. and SE in the syllabification of the Diola Fogny word /a-jaw-bu-ŋar/ 'voyager'. Three

[31] The theory of Lexical Phonology will be briefly outlined in 3.3.2.3.

[32] Some other possible formulations are found in the literature (see Harris 1994: 190, Steriade 1996: 125).

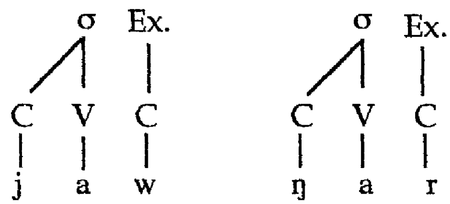
cyclic derivations in the lexicon and finally the post-lexical derivation will be observed, which are illustrated in (37). A derivational process is briefly sketched out: in the first cycle, *w* in *jaw* and *r* in *ŋar* are established as extrasyllabic, since they do not accord with the coda condition of Diola Fogny. Extrasyllabicity continues until the post-lexical phonology, where extrasyllabic segments are syllabified. However, after compounding in the third cycle, *w* in *jaw* is no longer extrasyllabic, hence SE takes place, as seen in (37c). The syllable template and the coda condition of Diola Fogny are as stated in (33) above. Derivational processes are cited from Itô (1986: 71-73).

(37) /a-jaw-bu-ŋar/

<u>Lexical Derivation</u>

a. <u>1st cycle</u>

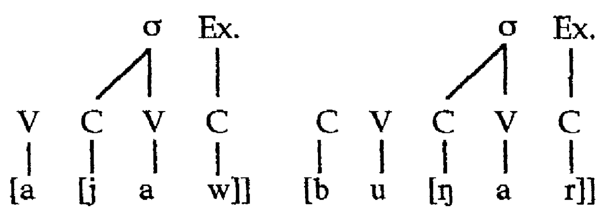
Syllabification/Ex.:



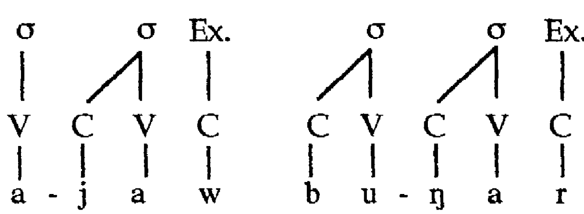
SE: inapplicable

b. <u>2nd cycle</u>

Affixation:



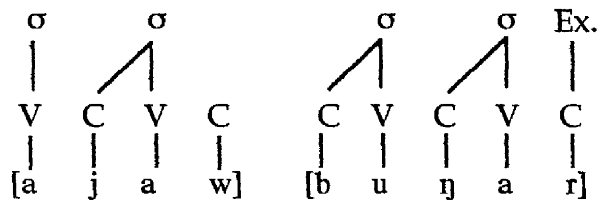
Syllabification:



SE: inapplicable

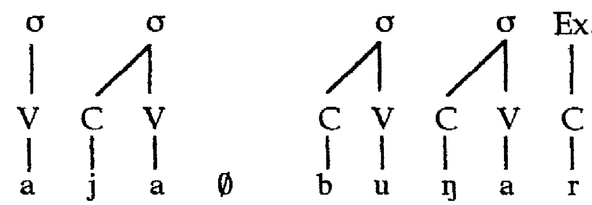
c. 3rd cycle

Compounding:



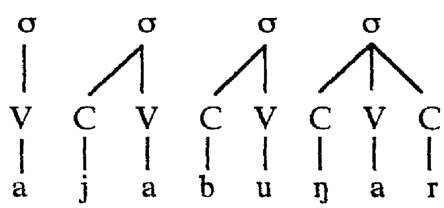
Syllabification: blocked by the SP

SE:



Post-lexical Derivation

d.



SE: inapplicable

All melody segments in (37a) are either syllabified or extraprosodically licensed, hence SE is not triggered. In the second cycle, both *w* in *jaw* and *r* in *ŋar* are extraprosodic. In the third cycle, the *w* loses its extraprosodicity since it is now in an internal position and cannot be syllabified as a coda in accordance with the Diola Fogny Coda Condition. Therefore, the *w* undergoes SE, and SP is respected. However, the *r* is allowed to be extraprosodic at this point. Finally, since SP no longer holds postlexically, the *r* loses extraprosodicity and consequently it is incorporated in the final syllable as in (37d).

The domain of SP, Ex. and SE is summarized as follows. SP is respected in the lexical phonology but absent in the post-lexical phonology. Likewise, SE and Ex. are respected in the lexical phonology only. Since SP does not hold in the post-lexical phonology, extraprosodic segments, if exist, are syllabified in the post-lexical phonology. Hence, Prosodic Licensing holds both in the lexical phonology and in the post-lexical phonology.

To sum up, the concept of Itô's continuous templatic syllabification is handled by syllable well-formedness conditions and a directional parameter. The template itself expresses well-formedness. Two main assumptions about syllabification are expressed by Structure Preservation, which protects a language-specific well-formedness condition, i.e., a template, and also by Prosodic Licensing, which functions as the universal association mechanism throughout a derivation, i.e., an initial syllabification, reassociation and dissociation.

Itô (1986: 4-7) points out that rule-based syllabification takes place under the set of syllable building rules, and the rules in this approach duplicate part of the well-formedness conditions on syllable structure. She adds that this kind of redundancy is a serious problem, which leads her to prefer the templatic approach.

2. 3. 3 The Moraic Approach

The two types of approach to syllabification seem to take rather similar procedures by stipulating appropriate conditions. However, they differ in one point, which is whether syllable structures are built up as in the rule-based approach or are present by complying with conditions and templates as in the templatic approach. This fundamental difference could enable each approach to show its strength in handling certain phonological derivations.[33]

Syllabification in the moraic theory employed in this thesis could be characterized as a hybrid of these two approaches in the sense of having rule-based built-up syllabification. However, also with a few universal syllable templates, i.e., monomoraic and/or bimoraic and/or trimoraic syllable(s). Before syllabification within the moraic approach is discussed, the following two points are noted.

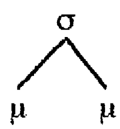
First of all, Prosodic Licensing in Itô's sense does not necessarily hold over syllabification in the moraic approach. Although all segments need not belong to a higher prosodic structure, they must be associated with a mora in

[33]See Kenstowicz (1994), Harris (1994), and Blevins (1996) for discussion about syllabification.

order that phonetic realization takes place. Moreover this approach allows any segment to remain unsyllabified if conditions governing the construction of a syllable are not satisfied. In practical analysis, however, an unsyllabified segment is to be seen as a last resort only.

Next, having morae as the skeleton implies that the moraic approach does not need to have a well-formedness condition, a (language-specific) template[34], since a mora, a universal entity, is associated with each segment lexically. As this holds for any language, it therefore dispenses with a template in a broad sense. On the other hand, in a strict sense, if a language allows a maximally bimoraic syllable as in (38), this provides a sort of template into which strings of morae could be parsed.

(38)



Nonetheless, in the moraic approach, there seems no redundancy in terms of well-formedness conditions as Steriade (1982) points out, since all the syllable types, i.e., monomoraic, bimoraic and trimoraic syllables, are dealt with in terms of whether a language has the MCR, the OAR, etc. There would be redundancy if we had a template such as σ

|

μ

| \

[C, (S)] as well as the MCR.

However, we need certain conditions for the MCR so that a bimoraic syllable involving a CVV sequence is distinguished from a CVVC sequence found in such a syllable.

2. 4 Syllabification in the Moraic Theory

In the first three sections, conditions and essential rules which are universally and language parametrically required for syllabification within the moraic theory as employed in this study will be discussed. Following this, I shall deal

[34] Noske (1992: 31 fn 10) points out that Itô's term 'template' seems to have an unstable meaning.

with a problem inherent to Hyman's approach in distinguishing glides from their corresponding high vowels in terms of employing the concepts of the Feature Geometry advocated by Clements (1985, 1991a), Sagey (1986), McCarthy (1988), Halle (1992), and Clements and Hume (1996), among others. In the final section, I shall discuss syllabification of uninterrupted vowel sequences.

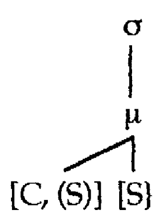
2. 4. 1 The Least Syllable Condition and Certain Assumptions

Syllabification in the moraic theory in this study requires that the following two assumptions, and the 'Least Syllable Condition' (LSC) should be respected for the construction of a syllable.

(39) Assumptions

a. Syllabification takes place strictly from left to right.
b. The Onset Creation Rule is the first rule to apply.

(40) The Least Syllable Condition



As can be seen in (40), a left-branching (co-linked) mora is the least condition for creating a syllable in the moraic theory this thesis employs. The LSC expresses the claim that an onset is an essential component in order for a string to constitute a syllable. However, a 'coda' consonant is optional, as other theories hold.

In the following sections, the universal Onset Creation Rule, and language-specific rules and conditions such as the Margin Creation Rule, the Onset Adjunction Rule, Glide Formation, Onset Condition and Coda Condition are discussed. However, an onset[35] is not always underlyingly presented, for

[35] The term 'onset' has no theoretical/constituent status in this approach. 'Onset' is just a convenient way of referring to a consonant segment to the immediate left of a vocalic segment co-linked to the same mora.

example, as when a word begins with a vowel orthographically - such as the Japanese word *aka* 'red'. Such a case will be examined in 2.4.5.

2. 4. 2 Essential Rules and Conditions

In this section, rules which deal with single pre-/post-vocalic segments are presented.

2. 4. 2. 1 The Onset Creation Rule

Following Hyman (1985), the Onset Creation Rule (OCR) takes place when a consonantal segment is followed by a vocalic segment, and as a result the mora associated with the pre-vocalic consonantal segment is removed and the consonantal segment is incorporated into the mora linked to the vocalic segment. I diagram the process of the OCR in (41a), where I replace Hyman's x with μ, and his [+cons] and [-cons] with [C, (S)] and [S] respectively. (41b) provides exemplification for the more general representation.

(41) Onset Creation Rule

a. b.

As can be seen in (41a), the operation of the universal OCR involves removal of the mora from the melodic segment specified as [C, (S)] (exemplified by *t* in (41b)), and reassociation of the latter with a mora linked to a melodic segment specified as [S] (exemplified by *a* in (41b)) to its right. As a consequence, a branching mora is created.

However, (41) will not allow a glide (G) and a vowel (V) sequence (i.e., [S]-[high][S] sequence[36]) to undergo such an operation, which creates a minimal syllable, since (according to our approach) both segments are specified as [S]. However, a glide when it is not preceded by a consonant may very generally be realized as onset to a following vowel. This happens both in KiMvita and Japanese. Hyman actually discusses this matter in connection with

[36] In running text, a high vocoid is represented by means of a linear (rather than hierarchical) association of the [high] feature; this is for ease of exposition (see also 4.2.1).

'glide formation' (GF), which he applies to a GV sequence. As a consequence, such a sequence comes to share one mora. Hyman uses GF for a GV sequence (or two [S] segments) as well as for a CGV sequence, since the two [S] segments do not undergo the OCR as defined in his terms. However, Hyman's GF deals with a case in which a G is considered to be consonantal, but it does not deal with a case in which a G comes to be a component of a light diphthong, and hence has a vocalic nature. The latter case is seen in KiMvita, and probably in other languages. Therefore, I shall need to revise the OCR of (41); this will be discussed in detail in 4.2.1.

2. 4. 2. 2 The Margin Creation Rule

Treatment of post-vocalic consonants is a language-specific matter, unlike a pre-vocalic consonant which undergoes the universal OCR. The MCR is designed for a situation where a post-vocalic consonant does not contribute to syllable weight. Therefore, if the MCR operates, a post-vocalic consonant becomes weightless. I repeat the process of the MCR in (42a). (42b) provides exemplification for the more general representation.

(42) Margin Creation Rule

a. b.

The structures in (42) illustrate the language-specific rule, the MCR. As we have already seen in chapter 1, the process of the MCR is the mirror image of the OCR, i.e., the dissociation of the post-vocalic consonant from its mora is accompanied by the leftward reassociation of it with a mora which links to the preceding [S] segment. Therefore, two morae are reduced to one, which means that no contribution to syllable weight is provided by the post-vocalic consonant.

If a post-vocalic consonant does contribute to syllable weight, certain conditions for such a segment may need to be stipulated along with the MCR. In KiMvita, for example, post-vocalic consonants are not subject to the MCR; such consonants are /b, d̪, f, s, ʃ, k, h, l, r, n/, and all retain their moraicity. In the case of Japanese, the only consonants that could possibly undergo the MCR would be the moraic nasal and part of a geminate consonant, but the MCR does not operate on them, and language-specifically Japanese does not have this rule. However, the occurrence of such moraic nasals and parts of geminate consonants requires a statement or syllable condition so that only they are allowed to occur post-vocalically. I shall discuss these matters in chapters 4 and 5 dealing with KiMvita and Japanese respectively.

2. 4. 3 Additional Rules

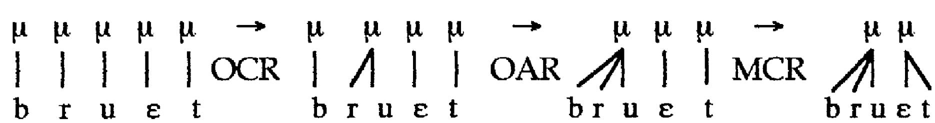
We have discussed two rules, which deal with a single 'onset' / 'coda' consonant. In this section, rules which create complex onsets and complex margins ('codas') will be considered. Moreover, a rule which concerns glide formation requires discussion. I will examine Glide Formation (GF) advocated by Hyman first, and then raise the question of whether or not it is adequate.

2. 4. 3. 1 The Onset Adjunction Rule and a rule for a complex margin

Hyman (1985: 18) states, "Additional rules will be needed ... which allow consonant sequences within the same WU (i.e., mora in this theory). These rules ... obey a sonority hierarchy ...". This statement says that if a consonant sequence is a permissible cluster of the language in question then the consonant cluster associated with distinct morae in the earliest stage comes to share one mora.[37] Therefore, for example, permissible onset consonant clusters require a rule such as the Onset Adjunction Rule (hereafter OAR). Likewise a rule for a complex margin is required by a permissible 'coda' consonant cluster.

Hyman (1985) demonstrates such a case using the French word *brouette* [bruɛt] 'wheel-barrow'. Three rules operate in the order shown in (43), where certain details are omitted.

(43) a. b. c. d.

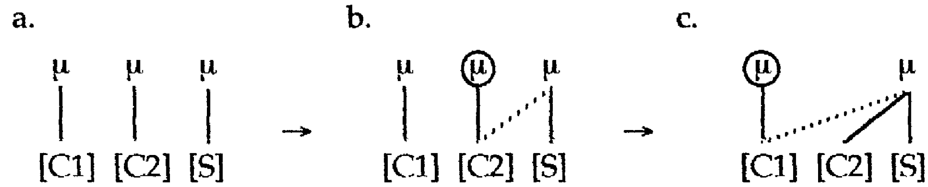


[37] I assume that Hyman's statement refers only to underlying consonant clusters, but not to underlying complex segments, for example, /tʃ/, which is presumably associated with one mora in the earliest stage in most languages.

Hyman (op. cit.: 80) explains, "... a single application of the French onset adjunction rule (OAR) applies in (43b), removing the WU (i.e., mora) of the initial *b* and joining it to the following WU (i.e., mora)".

Although Hyman does not demonstrate the operation of the Onset Adjunction Rule explicitly, it could be depicted as in (44) in accordance with (43b and 43c) above. In (44), [C, (S)] is simplified to [C] for ease of exposition.

(44) Onset Adjunction Rule



The OAR in (44) says that when a permissible onset cluster precedes a [S] segment, firstly the OCR takes place between a [C2] segment and a [S] segment, and next a [C1] segment is adjoined to the already co-linked mora, which has resulted from the OCR.

In order to operate the OAR, a certain condition needs to be specified. In English, for example, it is generally said that in a C1C2 sequence at the beginning of words, C1 must be an obstruent. (However, this is, of course, not enough to account for all possible C1C2 sequences.) Among the many proposals that have appeared in the literature (e.g., O'Connor and Trim 1973[38], Selkirk 1982, Clements and Keyser 1983, Harris, 1994) I shall briefly sketch out Selkirk's (op. cit.: 346) constraints for onset clusters, which are: (i) only stops and voiceless fricatives occupy C1; (ii) *j* ([ž]) never appears in the C2 position; (iii) *m* and *n* are preceded only by *s*; (iv) *w* never appears after labial consonants, *š*, or *st*; (v) *r* never appears after *s* or *h*;[39] (vi) *l* never appears after *t, d, š ,h* or *sk*.[40] For example, the following consonant sequences are excluded from English onset clusters in accordance with the restrictions stated above; **pw*, **sr*, **dl*, **kj*, and so on. On the other hand, *bl*, *sn*, *tr*, etc. are well-formed onset clusters. The former group may not share the same mora, while the latter group of sequences may share a single mora.

I do not attempt to illustrate conditions for an English Onset Adjunction Rule here. However, I might mention a condition for onset clusters in Sinhala. Based on the condition provided by Steriade (1982) in section 2.3.1 above, it

[38] Especially for Southern British English.

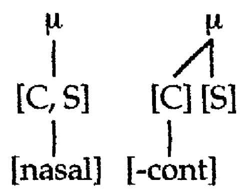
[39] Prohibition of an *s* +*r* sequence seems to be only a superficial phonetic observation; shrimp, shrew, etc. could all be *s* +*r* underlyingly.

[40] Selkirk (1982: 381 fn 14) states, "... *sclerosis, schlita* and others to be nonrepresentative".

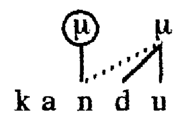
would be manifested under the current theory as shown in (45a). When this condition is satisfied the OAR takes place. An example, *kandu* 'hills', taken from Feinstein (1979: 271), is given in (45b).[41]

(45) Sinhala Onset Adjunction condition

a.



b.



The condition (45a) states that a moraic nasal is not permitted preceding a stop consonant. Hence, when a nasal precedes a stop consonant, the OAR occurs, and as a result, a nasal-stop onset cluster is obtained in Sinhala, as seen in (45b). As we will see in chapter 4, the OAR is found to operate in a nasal-voiced stop sequence in KiMvita, although more specific conditions are required. I will return to conditions for the OAR in KiMvita in 4.2.2.1.2.

With respect to margin clusters, as mentioned above, Hyman does not propose a specific rule for them. However, he applies the MCR iteratively. Regardless of the name of the rule, a process for creating margin consonant clusters surely appears to behave as a mirror image of the OAR. I do not discuss this in detail.

2. 4. 3. 2 Glide Formation

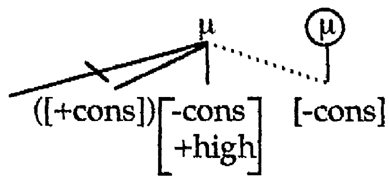
Hyman (1985) defines glides as follows: the surface glides are derived from underlying [-cons] segments (=vowels), and all surface glides receive the [+cons] specification. He advances Glide Formation (GF) in order to handle a sequence of [-cons][-cons] ([S][S]), where the leftmost [-cons] ([S]) is a high vowel, which cannot undergo the OCR, since the OCR occurs only in a sequence of [+cons][-cons] ([C, (S)][S]). Hyman (1985: 79-80) explains his GF using French and LuGanda examples. I shall sketch out GF in connection with these two languages first, and raise questions as to whether or not GF is really adequate to handle a sequence of [-cons, +high][-cons] ([S]-[high][S]) segments.

---

[41] In Feinstein, not all N+C sequences undergo the OAR; for example, a N+C sequence in the singular form *kandə* is syllabified heterosyllabically. Hence, a more specific condition may be required. However, I do not discuss this matter further here.

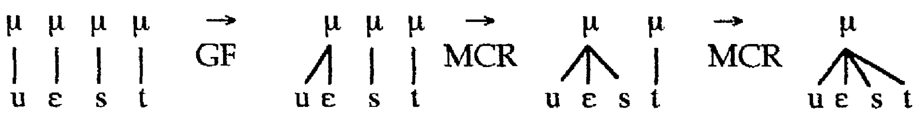
In French, a high vowel becomes a glide when it is followed by another vowel,[42] provided that not more than one consonant precedes the high vowel. Thus words *ouèst* 'west' and *rouette* 'osier band' are phonetically realized as [wɛst] and [rwɛt] respectively. A sequence /uɛ/ in both words undergoes GF, while a word such as *brouette* [bruɛt] 'wheel-barrow' as seen in (43) above does not undergo GF. Apparently there is a constraint on GF in French, which is that GF does not happen when a high vowel is preceded by more than one consonant. A representation of GF will be given in (46), where I replace Hyman's x with μ. The derivations for two words are illustrated in (47), where a detailed process is not shown.

(46)

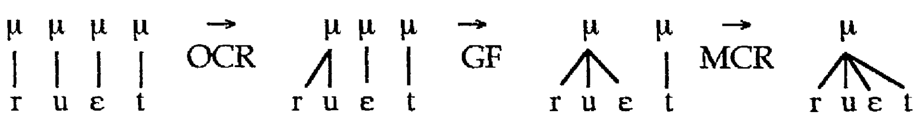


(adapted from Hyman 1985: 80)

(47) a.



b.



Hyman (op. cit.: 79-80) explains that the OCR does not apply to the /uɛ/ sequence because two [-cons] segments are involved, however, the vowel /u/ glides to become the onset on the following vowel. This explanation does not explicitly suggest that a [-cons, +high] segment becomes a component of a light diphthong. Moreover, according to his approach, all surface glides are [+cons], which would prevent an interpretation of a sequence of [-cons, +high][-cons] as a light diphthong. However, the /uɛ/ sequence in the word *ouèst* /uɛst/ should

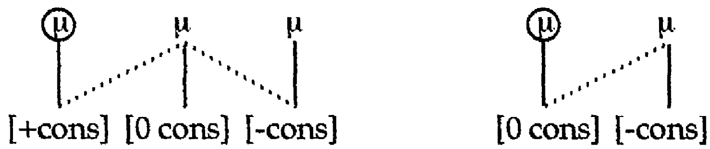
42 Presumably 'another vowel' is a non-high vowel or a high vowel with a different place of articulation.

be realized as a light diphthong because it takes the definite article *l'*, which is used for vowel-initial words.[43]

In LuGanda, GF is considered in connection with compensatory lengthening (hereafter CL). When a sequence of [-cons, +high][-cons] is preceded by a [+cons] segment, CL occurs and as a result a CGVV sequence is obtained. However, if no consonant precedes a [-cons, +high][-cons] sequence, no CL takes place and thus such a sequence contains only a short vowel. For example, /tu-a-lab-a/ 'we saw' is pronounced [twáálàbà] (= [tʷáálàbà]), but /u-a-lab-a/ 'you sg. see' is pronounced [wàlábà] (Hyman, op. cit.: 81).

In order to handle these two derivations, Hyman employs a [0 cons] specification for a high vowel, following Steriade (1982). The zero specification is interpreted as either + or - according to context. Diagrams are given in (48), where I replace Hyman's x with μ, and the association line from [-cons] to a μ linked to [0 cons] is mine.

(48) a. b.



(adapted from Hyman 1985: 82)

In (48a), a high vowel with a [0 cons] specification when preceded by a [+cons] segment functions as [-cons] and is involved in the OCR with the preceding [+cons] segment. This is then followed by GF. However, GF in LuGanda does not delete a WU associated with a [-cons] segment so that CL takes place. This point is different from French, and GF in LuGanda must be considered as language-specific, because CL in connection with a glide seems to be found in a limited number of languages. If GF is motivated to deal with such a language-specific phenomenon, GF itself cannot to be regarded as a (more) general rule. In the case of a [0 cons][-cons] sequence which is not preceded by a [+cons] segment, as in (48b), the [0 cons] segment functions as [+cons] and as a result such a sequence undergoes the OCR.

Regarding use of the [0 cons] specification, Hyman (1985: 82-83), in fact, points out that, "... we would have to explain why it is only the feature [cons] which has this peculiar interpretation of the zero specification as opposed to

[43] In addition to the word *ouèst*, words *ouïe* /ɥi/ '(sense of) hearing' and *iode* /jɔd/ 'iodine' take a definite article *l'*, and a word *ouate* /ɥat/ 'cotton wool' occasionally takes *l'*. However, words beginning with a y-glide or a w-glide of foreign origin take *le* or *la*. This suggests that French also requires the OCR to be revised. See also Noske (1992: 54 fn 6).

other cases of underspecification, where [0 F] would fail to satisfy the conditions for a rule requiring either [+F] or [-F] (see Kiparsky 1982b, Pulleyblank 1983)".

Four questions regarding Hyman's GF are raised.

(49)

a. How do we account for a nuclear WU (mora) that is deleted by undergoing GF?
b. Why does the same sequence [-cons, +high][-cons] have to undergo different rules depending on the language in question?
c. How do we account for the derivation of [±cons] from a [0 cons] specification - as Hyman himself points out?
d. Is GF capable of handling a high vowel which creates a light diphthong (or gliding vowel) with the following vowel?

The first question (49a) seems to be a serious flaw for Hyman's GF, since the more obviously sonorous WU is lost when GF takes place: if a stress falls on to a mora/syllable linking to a sequence involving (C)GV, the mora which is originally associated with a [-cons, +high] segment receives stress. However, according to Hyman, all such segments become [+cons] at surface level. This contradicts the usual assumption that stress is borne by the most sonorous segment.

Concerning (49c), if our monovalent major class feature system is employed and the OCR is revised, this problem will be resolved. Under the monovalent feature system, a [S](-[high]) feature specifies a glide throughout phonology. The OCR could be revised so that a sequence of [S]-[high][S] may undergo the OCR in certain environments according to what the language in question allows.

With regard to (49d), in a sequence of [+cons][-cons, +high][-cons] in KiMvita, a high vowel exhibits two different phonetic realizations, except that it remains as a vowel: (i) as a glide onto the preceding consonant, i.e., as a component of a complex consonant, [C$^{j/w}$]; (ii) as a glide onto the following vowel when forming a light diphthong, [Cĭ/ŭ]. The fact that the realization of a high vowel behaves not only a component of a complex consonant but also a component of a light diphthong requires two different rules for each derivation in, at least, KiMvita, since GF is advanced to handle a high vowel as a component of a complex consonant only. In addition to these, a high vowel becomes an onset when followed by another vowel and not preceded by a consonant, with exclusion of */ii/ and */uu/in many languages, including

KiMvita and Japanese. Thus, the OCR needs to be revised so that such a sequence can also undergo the rule. The questions (49a) and (49b) could be solved by revision of the OCR, which will be dealt with in 4.2.1. Based on the revised OCR, syllabification of a light diphthong involving Light Diphthong Formation and that of a complex consonant involving Complex Consonant Formation will be discussed in 4.2.3.1 and 4.2.3.2 respectively.

2. 4. 4 The Representation of Glides

2. 4. 4. 1 Problems with Hyman's representation

As mentioned in 1.2.4.2, the representation of glides in Hyman's model needs a careful consideration. I repeat Hyman's representations of [kja] and [kĭa] here (Hyman's x is replaced with μ.)

(50)

a. b.

(adapted from Hyman 1985: 78)

There are two important points to be considered regarding the representations in (50): (i) a problem for forming a natural class when a glide is specified as [+cons] underlyingly; (ii) the use of the [±cons] features causes redundancy. Concerning (ii), the use of the [-cons] feature for a high vowel causes redundancy when a high vowel retains its [-cons] feature, provided that Hyman applies his GF to a sequence involving a light diphthong. Moreover, when a glide is specified as [+cons] underlyingly, both [+cons] and [-cons] features are redundant.

The first point is not problematic, as has been mentioned in 1.2.4.3.2, in this study. Since the major class feature [S] applies to both vowels and glides, they would not need to be distinguished by the feature [cons] with a +/- specification. Hence, vowels and glides can form a natural class. However, a problem still remains as to how to distinguish [kja] from [kĭa] without invoking the [cons] feature. Consideration of feature-internal organization, about which Hyman is silent, could provide a solution. In order to deal with this problem, I shall consider the theory of Feature Geometry, which is examined in the following subsection.

2. 4. 4. 2 Feature Geometry

The flaw found in Hyman's representation of glides may be rescued by the theory of Feature Geometry (henceforth FG), especially Clements's (1991a) proposal about C(onsonantal)-place and V(ocalic)-place nodes; an incorporation of the V-place node under the C-place node, which is exploited for a representation of a segment involving a secondary articulation such as [p^w] or [k^j]. I shall briefly outline the ideas of FG first, and then go into the concept of the C-place and the V-place nodes.

Clements (1985), among others, argues that phonological analysis requires phonological features by means of which phonological segments are classified. The central idea of FG is that features are defined in terms of the organs of speech involved in their production, and they are organized into a hierarchical tree structure (see Clements 1985, 1991a, Sagey 1986, McCarthy 1988, Halle 1992, and Clements and Hume 1996, among others). The internal organization of the feature tree has been modified at various times in the course of the development of FG. However, it is generally understood that terminal features such as [round], [anterior], etc. are arrayed under articulator nodes such as [labial], [coronal], [dorsal] and so on, which are in turn dominated by the cavity nodes such as oral. Finally, the cavity and the manner features, such as [continuant], are seen as dependents of the root, which is itself defined by the major class features.

In the Halle-Sagey model, the oral place node dominates three articulator nodes, Labial, Coronal, and Dorsal, which characterize consonantal place, while the features [high], [low], [back], and [round] characterize vocalic place. Among these features, only [labial] and [round] exhibit a connection between consonantal and vocalic places. Clements (1991a) argues that a connection between consonantal and vocalic places is found not only in a [labial]-[round] relation but also in the case of other articulators. He (op cit.) proposes that the oral cavity features, [labial], [coronal] and [dorsal], are shared by both consonantal and vocalic places. He eliminates the features [back] and [round], and replaces the [high] feature with the aperture node which dominates the [open] feature. The relations between consonants and vocoids stated in Clements and Hume are given in (51).

(51)

[labial]: labial consonants; round or labialized vocoids
[coronal]: coronal consonants; front vocoids
[dorsal]: dorsal consonants; back vocoids

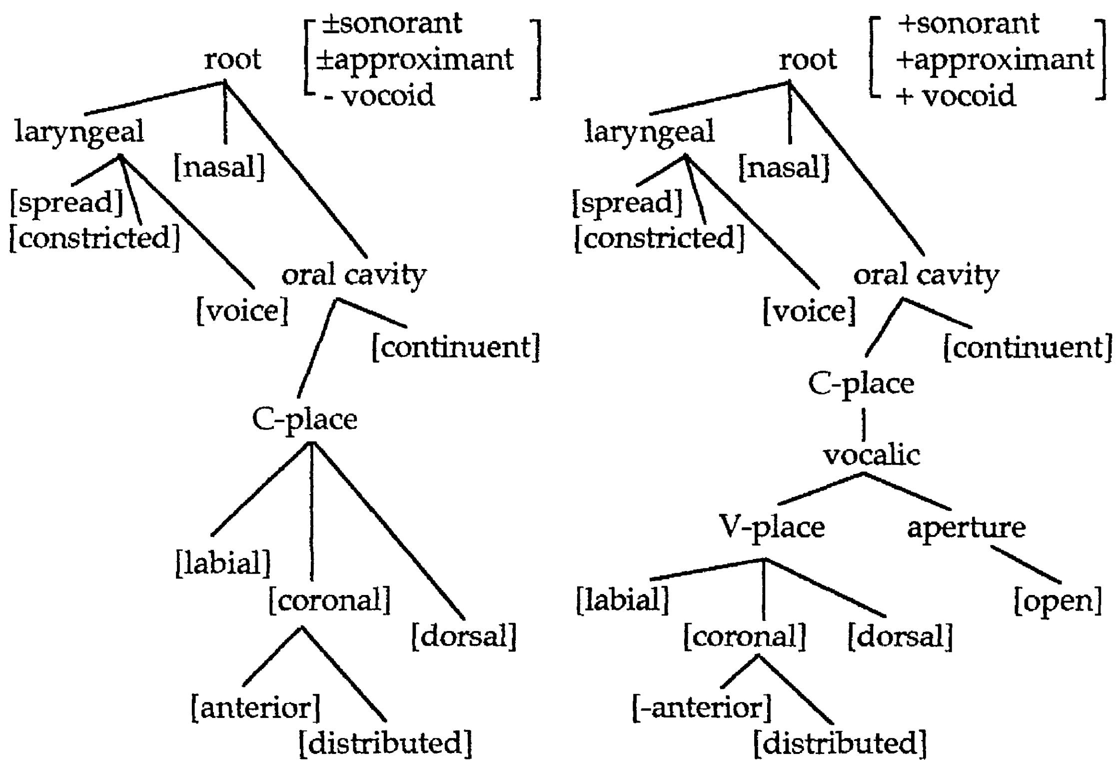
(Clements and Hume 1996: 277)

The three features can be accessed by the C-place node and the V-place node, and the latter is organized under the former. Here I cite their hierarchically organized feature tree for consonants and vocoids. In (52a), a vocalic node under the C-place node, which specifies consonants with secondary articulations, is omitted, thus (52a) represents only simple consonants, and (52b) represents vocoids.

(52)

a. Consonants

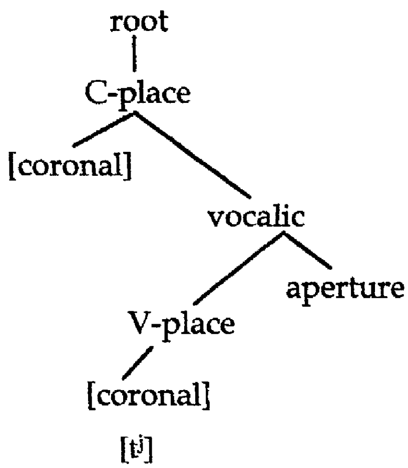
b. Vocoids



(Clements and Hume 1996: 292)

A representation of a consonant with a secondary articulation such as [t^j] is as depicted in (53), where the V-place node is incorporated under the C-place node via the vocalic node.

(53)



(Clements 1991a: 78)

In (53), it can be seen that the feature [coronal] under the C-place represents coronality for a consonant such as [t] and the feature [coronal] under the V-place represents a secondary (palatal) articulation. The V-place node located under the C-place node carries the implication that major articulator features are distinguished by node organization alone, since the major feature is always the superior node in the hierarchy (Clements and Hume 1996: 288).[44]

2. 4. 4. 3 An adoption of Feature Geometry

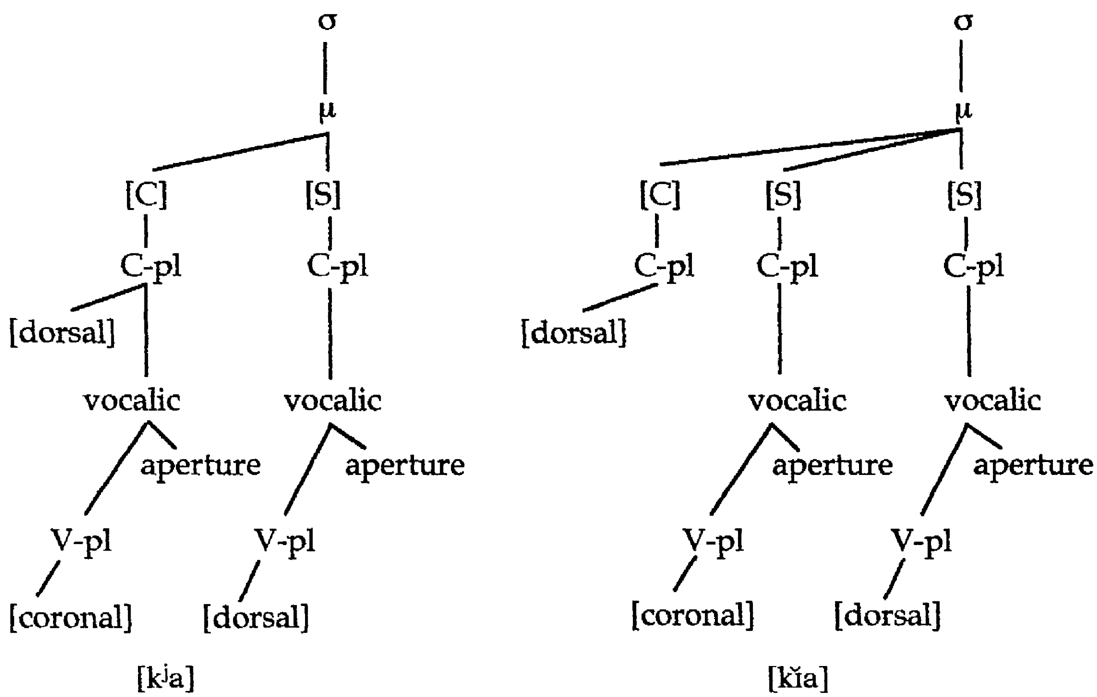
This study adopts the Clements and Hume's feature model in general to deal with problems found in Hyman's representation of glides. However, one problem might arise if their model is considered for the representation of a consonant with a secondary articulation. This is the term 'consonantal'. This term is already employed as one of the major class features for defining consonant segments, and is located in the root node in the adopted model. Thus it seems to be redundant and a disadvantage for the framework being used. However, if the term 'Consonantal-place' is interpreted as not expressing a feature of consonantality but simply the 'place node', then there could be no objection to employing Clements and Hume's efficient feature organization model.

Following Clements and Hume's feature tree, $[k^ja]$(=[kja]) and [kĭa](=[kia]) are as shown in (54).

[44] The terms 'primary' and 'secondary' are a phonetically based distinction, while Sagey (1986, 1988) proposes the terms 'major' and 'minor' as a phonological distinction.

(54)

a. b.



As can be seen in (54), a consonant with a secondary articulation, [k^{j}a], consists of two root nodes while three root nodes are found in a sequence involving a light diphthong, [kĭa]. When [k^j] is found underlyingly, one root node specified as [C, (S)] is considered as in (54a). However, if C^G is formed as a result of a derivation, two root nodes are seen at an early stage and these are reduced to one in the course of syllabification-related processes. I will discuss the syllabification of a derived complex segment in 4.2.3.2.

In sum, by adopting Clements's (1991a) proposal, i.e., the C-place and the V-place nodes and incorporation of the V-place node under the C-place node in the feature tree, the problems found in Hyman's representation of glides have been solved. The crucial point is the number of root nodes which is considered for an underlying representation. While a sequence CG involving a complex consonantal segment in an onset, i.e., a consonant with secondary articulation, contains only one root node underlyingly, two root nodes occur in a sequence CG where a G is regarded as a component of a complex nucleus, i.e., a light diphthong. These are all at the level of underlying representations, however, as will be seen in chapter 4, a derived complex consonantal segment is found in KiMvita. In this case, the number of underlying root nodes is two, viz., both a C and a G are associated with distinct morae underlyingly. In the course of syllabification-related processes two morae and two root nodes become one.

2. 4. 5 Syllabification of Uninterrupted Vowel Sequences

As already mentioned in chapter 1, Hyman (1985) discusses the case of Gokana in which it is argued that an uninterrupted six-vowel sequence is not necessarily syllabified. However, this seems to be a rather rare case. In general, languages do seem to tend to complete an exhaustive syllabification of all morae, and various phonological processes operate to facilitate this. Thus in Southern British English, if certain uninterrupted vowel sequences occur at a word or a morpheme boundary, the so-called *r*- insertion rule applies so that an *r* may become an onset consonant for the last vowel. For example, in *India and Pakistan*, an *r* is inserted between two successive *a*'s and it will become an onset consonant for the second *a*. Likewise, in *draw-ing*, an *r* commonly appears in colloquial pronunciation before *i*. I shall discuss how other languages deal with the problem of unsyllabifiability of such a case in this section. Three languages are chosen for the discussion of this issue; Saho (following Hayward 1997), KiMvita and Japanese.

2. 4. 5. 1 The Saho case

In Saho, as we have already seen in 2.1.4.3, a long vowel will be preserved unless a final consonant closes a syllable, in which case a long vowel undergoes the Long Vowel Contraction Process (henceforth LVCP). However there is a case in which a long vowel followed by a syllable closing consonant rejects the LVCP, and thus a sequence of CVVC is kept. This class of exceptions has been analyzed by Hayward as bisyllabic (Hayward 1997: 66). If it is bisyllabic, the apparently final consonant actually closes only the second syllable. Thus the LVCP need not be invoked. The point here is to understand how the second syllable, which begins with a vowel, is syllabified. Hayward (op.cit.: 65-69) discusses the syllabification of this rather special case as follows.

Two words selected for consideration are the 3rd person singular possessive determiners *ka⃰a* 'his' and *t⃰ee* 'her'. They normally undergo the LVCP when a vowel initial word follows, though a long vowel is clearly heard when it is followed by a consonant-initial word. Nonetheless, there are circumstances in which the LVCP is not respected. Examples of these three cases are shown in (55). In this subsection all examples are cited from Hayward (1997: 65-67).

(55)

a.	ka⃰a + saga	→	[kʰa:]saga	'his cow'
	te⃰e + ḍaw	→	[tʰe:]ḍaw	'her voice'
b.	ka⃰a + iko	→	[kʰa]iko ~ [kʰaj]iko	'his tooth'
	te⃰e + okolo	→	[tʰe]okolo	'her donkey'
c.	ka⃰a + af	→	[kʰa:f]	'his mouth'
	ka⃰a + abba	→	[kʰa:b]ba	'his father'

The examples in (55c), where the LVCP fails to apply, need to be explained. According to Hayward (op. cit.), there are also quite a number of words which reject the LVCP word-internally. They include nouns which contain a long vowel followed by a final consonant. Their plural forms, which employ ablaut, could explain why the LVCP is not obeyed. Singular and plural forms of these words are shown in (56).

(56)

Singular	Plural	Gloss
sa⃰ar	sa⃰ur ~ sa⃰wur	'water skin'
fa⃰as	fa⃰us ~ fa⃰wus	'axe'
ma⃰al	ma⃰ul ~ ma⃰wul	'money'

It is important to note that a similar ablaut pattern is also exploited in plural forms of bisyllabic consonant-final nouns, which are shown in (57).

(57)

Singular	Plural	Gloss
danan	da⃰nun	'donkey'
faras	fa⃰rus	'horse'
a⃰ʕan	a⃰ʕun	'frog'

The plural forms in (57) could be regarded as plausible evidence that words such as sa⃰ar, fa⃰as and so on could also be treated as bisyllabic. Hayward (op. cit.: 66) states, " ... this would account not only for the parallels in plural formation with words that are undoubtedly bisyllabic, but would also explain why what appear to be long vowels fail to undergo the LVCP in the appropriate environment".

No support for a bisyllabic interpretation, however, appears in certain verb forms containing a long vowel, in some of which there seems to be no evidence for treating them as bisyllabic, for example, *oobbe* 'I heard', *neerre* 'we loaded something'. However, there are some cases where a derived long vowel can clearly be demonstrated. They appear in sequences containing a deleting y- glide between front vowels. For example, *bey-e* 'he took' becomes [be:], and *difey-e* 'he sat down' becomes *di* [fe:]. The long vowels resulting from the *y* deletion seen in these cases do not undergo the LVCP even when a closing consonant is added. For example, if the nominalizing clitic *m* is added to these words, a long vowel remains intact. Examples are shown in (58).

(58)

a. bey-e + m teeɖege → [beːm] teeɖege 'She knew that he took (it).'
b. difey-e + m nuble → di[feːm] nuble 'We saw that he sat down.'

To account for this derivation, Hayward (1997: 67) suggests "... the deletion (dissociation) of *y* in *bey-e* → [beː] only affects features dependent upon the root node ([RN]) while not affecting the root node itself, which remains intact. Effectively then there as many moras and syllables after the deletion as before it". Diagrams of [beː] and [beːm] are represented in (59).

(59)

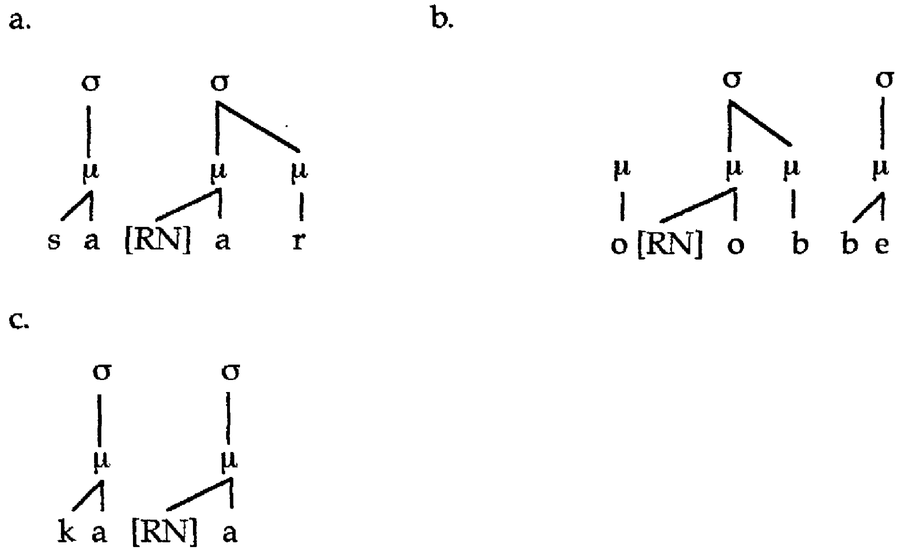
a. b.

(Hayward 1997: 67)

In (59b), it is clearly seen that the clitic *m* closes only the second syllable. Thus the condition for the LVCP is not met.

Hayward extends this idea to account for all cases in which the LVCP fails to be applied, for example, nouns such as *saar* etc., verb forms such as *oobbe* etc., and morphemes ending with a vowel such as *kaa* and *tee*. The structure for these cases will contain a root node in an intervocalic position without any dependent features in its geometry. The relevant structures are depicted in (60).

(60)

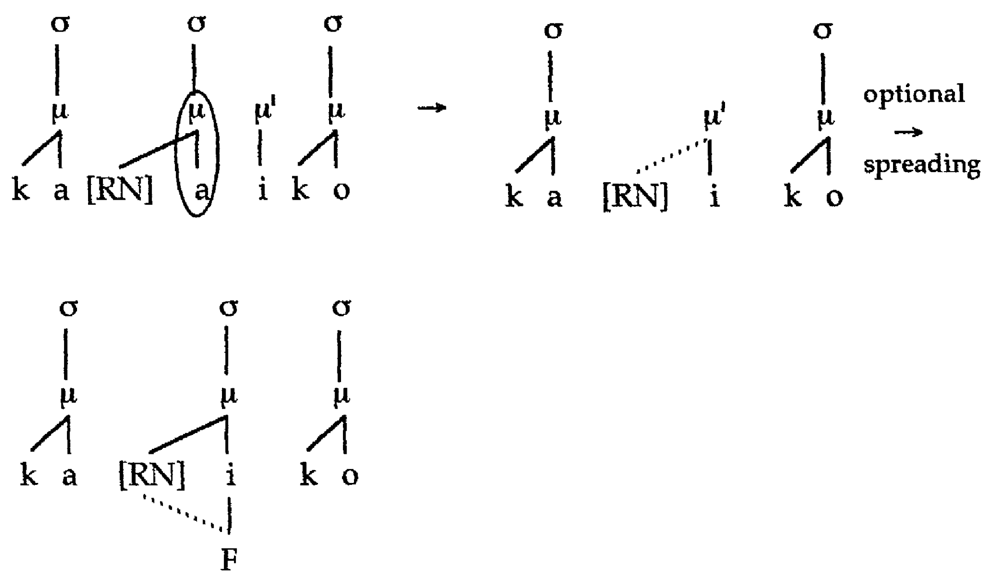


(Hayward 1997: 68)

The difference between the structures in (59) and (60) is that while in the former the bare root nodes are derived, in the latter they are inherent.

Hayward continues to discuss the variant forms of $\overset{*}{kaa}$ and $\overset{*}{tee}$ followed by words beginning with high vowels; $\overset{*}{kaa}$ + *iko* → [k^{h}a]iko ~ [k^{h}aj]iko 'his tooth', and $\overset{*}{tee}$ + *ure* → [t^{h}e]ure ~ [t^{h}ew]ure 'her smell'. When the word *iko* 'teeth' is added to $\overset{*}{kaa}$, for example, the dissociation of *a* is realized as a consequence of the LVCP; however, the root node remains. Then optional spreading of the palatal feature to the bare root node takes place. (Likewise, in the case of words beginning with the high rounded vowel the appearance of [w] is accounted for in a parallel way.) The representation of this process is illustrated in (61).

(61)



(Hayward 1997: 68-69)

In sum, uninterrupted vowel sequences found in Saho usually undergo the LVCP under the appropriate circumstances. However, in some exceptional cases, where the LVCP fails to apply, two vowels in a sequence of CVVC are analyzed as belonging to distinct syllables, and a root node plays a role as an onset to the second vowel. The nature of the [RN] is twofold; derived and inherited.

2. 4. 5. 2 The KiMvita case

Uninterrupted vowel sequences are also found in KiMvita as shown in (62), where 2nd, 3rd, sg., sb., obj., and fv. indicate 2nd person, 3rd person, singular, subject, object and final vowel respectively.

(62)

a. /aua/ (a: 3rd sg. sb., u: kill, a: fv.)
's/he kills'

b. /aiua/ (a: 3rd sg. sb., i: Cl. 9 obj., u: kill, a: fv.)
's/he kills it'

c. /aiiba/ (a: 3rd sg. sb., i: Cl. 9 obj., ib: steal; a: fv.)
's/he steals it'

d. /aiona/ (a: 3rd sg. sb., i: Cl. 9 obj., on, see; a: fv.)
's/he sees it'

e. /auona/ (a: 3rd sg. sb., u: Cl. 3 obj., on: see, a: fv.)
's/he sees a tree'

f. /uianike/ (u: 2nd sg. sb., i: Cl. 9 obj., anik: put to dry, e: fv.)
'you put it (out in the sun) to dry'

Pronunciations obtained from Sh. Yahya show a glide insertion in vowel sequences except in the case of diphthongal type sequences such as /ai/ and /au/. For example, after the vowels /u/ or /o/ the glide /w/ is epenthesized whereas the glide /y/ is inserted after the vowels /i/ or /e/. In addition, a glottal stop is always heard before a vowel-initial word/phrase when it is uttered. Therefore, the examples in (62), /aua/, /aiua/, /aiiba/, /aiona/, /auona/, and /uianike/ are realized as /au[w]a/, /ai[j]u[w]a/, /ai[j]iba/,[45] /ai[j]ona/, /au[w]ona/, and /u[w]i[j]anike/ respectively.[46] Syllable structures for words such as /auona/, /aiua/, and /aua/ are depicted as in (63), where the procedure for syllabification is simplified. Therefore the outputs here only demonstrate how a glottal stop or inserted glide plays a role as an onset to the following vowel, and, as a result, all the vowels are syllabified. In other words, they do not remain unsyllabified as in the case of Gokana Hyman analyzes (see 1.2.4.3.1). This syllabification can be justified provided that the inventory of the syllable in KiMvita contains both monomoraic (light) and bimoraic (heavy) syllables, and

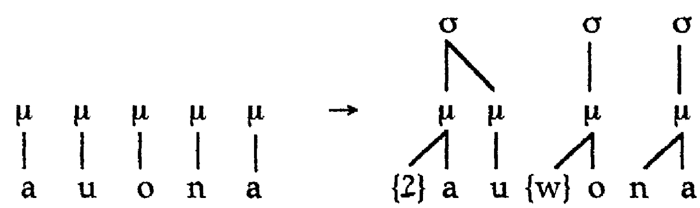
[45] KiMvita generally forbids /yi/ sequences in the lexicon, however, the y-glide epenthesis could yield such sequences in the post-lexical phonology.

[46] In the case of the word, *uianike,* the glide insertion between *u* and *i* is rather weak in my informant's pronunciation.

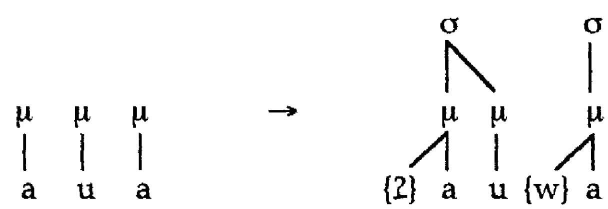
that the stress bearer is the mora regardless of its position, i.e., whether it is either the first or the second mora of a (bimoraic) syllable. The structure (63b) exhibits the stress bearer where it coincides with the second mora of a syllable. These two issues will be discussed in 3.4 and 3.5 respectively. In (63), a segment is enclosed in brace brackets, which indicates that it is an epenthetic segment.

(63)

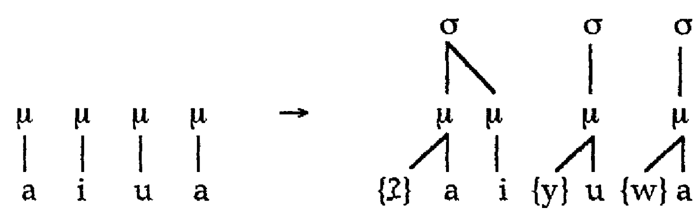
a. /auona/: [auwóna]



b. /aua/: [aúwa]



c. /aiua/: [aiyúwa]



({ } indicates an epenthetic segment)

As in many languages, so also in KiMvita, a glottal stop is heard before a vowel-initial word/phrase, and it is considered as an onset to the initial vowel. Regarding word-/phrase-internal vowel sequences, the glide insertion occurs; the y-glide is inserted after the vowel /i/ or /e/, while after the vowel /u/ or /o/ the w-glide epenthesis occurs.

2. 4. 5. 3 The Japanese case

An uninterrupted vowel sequence which consists of more than two vowels is generally found within a phrase or a sentence, but not within one morpheme (word) in Japanese.[47] Such words are mostly derived in adjective suffixation, e.g., a stem + an adjective formative *-i*; for example, *ao-i* 'blue-adj.'. An object marker, *-o*, and a direction marker, *-e*, also create a long vowel sequence, for example, *koo-o* 'back hand-obj.', and *ie-e* 'house-to' respectively. By combining such phrases, an eight-vowel sequence can be created, such as *Watasi-wa ao-i ie-e itta* ' I went to a blue house'.

In order to syllabify such an uninterrupted vowel sequence, some phonological facts in Japanese should be taken into consideration: (i) a syllable (in the underived lexicon) may contain maximally two morae; (ii) a glottal stop plays a role as an onset consonant to a vowel-initial morpheme; (iii) the second mora of a syllable may not bear accent; (iv) unlike KiMvita, a glide epenthesis as an onset consonant does not occur within a vowel sequence. Having these facts in mind, various hypotheses to provide syllabification of such an eight-vowel sequence could be made as in (64). [48]

(64)

(i) Following Hayward (1997), an inherent bare root node may be posited as existing between a sequence of two vowels, including a seemingly long vowel, in the lexicon.

(ii) Glottal stops are intercalated when a vowel-initial morpheme is uttered.

Concerning a long vowel stated in hypothesis (i), in Japanese, it could always be regarded as a sequence, because every combination of vowels is attested, which implies that a long vowel is not monosegmental but bisegmental. Such bisegmental long vowels could be exposed to the *babibu* language as discussed in 2.1.4.1. In the *babibu* language, each mora is followed by a syllable either *ba*, *bi*, *bu*, *be*, or *bo* according to the vowel a mora links to. When a word contains a long vowel, it is separated by two inserted syllables; e.g., *okaasaN* 'mother' becomes *o-bo-ka-ba-a-ba-sa-ba-N-bu*.

In a slow speech rendering of the sentence *'Watasi-wa ao-i ie-e itta'*, a glottal stop is clearly heard between morpheme boundaries, i.e., between *a-a* of *wa ao-i*, between *i-i* of *ao-i ie*, and *e-i* of *ie-e itta*. Hence a glottal stop comes to function as an onset consonant in these three cases. A glottal stop is also realized before a particle, hence while no glottal stop intervenes between *o* and *o* in *koo* 'back of hand', a glottal stop may be realized between *o* and *o* in *ko-*

[47] There are at least two exceptions that have been noted; i.e., *aoi* (N) 'mallow' and *uiuisi-i* (A) 'innocent'.

[48] See 5.3.2.2.2 for a more detailed discussion concerning vowel-initial morphemes.

o 'child-object marker'. Likewise, realization of a glottal stop is found between *e* and *e* in the noun phrase *ie-e.*

Regarding the noun *ie* 'house' and the adjective *ao-i* 'blue', these need careful inspection, since in both cases an accent falls on the second segment, which violates the Accent Bearer Constraint (hereafter ABC). Firstly, the word *ao-i*, which is derived from suffixation of an adjective formative *i*, is examined. Accent location moves from the first mora to the second mora of the stem *ao* after the adjective formative suffixation takes place. This is represented schematically as follows: $\overset{*}{\mu}\mu + \mu \rightarrow \mu\overset{*}{\mu}\text{-}\mu$, therefore, $\overset{*}{a}o + i \rightarrow a\overset{*}{o}\text{-}i$. Such a derivation is also found in words such as $k\overset{*}{u}ro + i \rightarrow kur\overset{*}{o}\text{-}i$ 'black-adj.', $s\overset{*}{i}ro + i \rightarrow sir\overset{*}{o}\text{-}i$ 'white-adj.', etc.[49] In these words, an accented mora is also linked to a consonant, therefore, there is no violation of the maximum number of morae per syllable or that of the ABC. However, a closer look reveals that all three words under the discussion here exhibit the same change in accent location. Such a shift in the location of accent, which violates the norms of Japanese, suggests that such forms may actually be bisyllabic. Following the Saho case discussed by Hayward (1997) above, it is not inconceivable to postulate that the adjective *ao-i* may contain an inherent bare root node (hereafter an inherent root node) before the vowel *o*; hence, 'a[RN]oi'.

In the case of *ie*, an accent falls on the *e* regardless of the attachment of a directional particle *e*, which means that if the word *ie* were to be regarded as a one-syllable word, the ABC would have been violated since once again the second mora bears the accent. Some words which also contain the accented second vowel in a two-vowel sequence are found in nouns and non-past verb forms; for example, $ti\overset{*}{e}$ 'wisdom', $hi\overset{*}{e}$ 'the chill/the cold', $hi\overset{*}{e}ru$ 'get cold', etc. However, in these examples, neither a morpheme boundary is found nor any corresponding examples which involve a consonant within the vowel sequence. Two hypotheses could be considered: (i) the case is to be treated as special; (ii) the presence of a bare root node should be considered. Hypothesis (i) is not conceivable, since even if I revise the ABC (see 5.3.3.2.3.2); viz., the last mora may not bear accent, its violation is inevitable. On the other hand, it might be plausible to posit an inherent root node before the accented vowel by virtue of the same accent location, i.e., the second mora, as in the case of *ao-i*; thus, *ie* → 'i[RN]e'.

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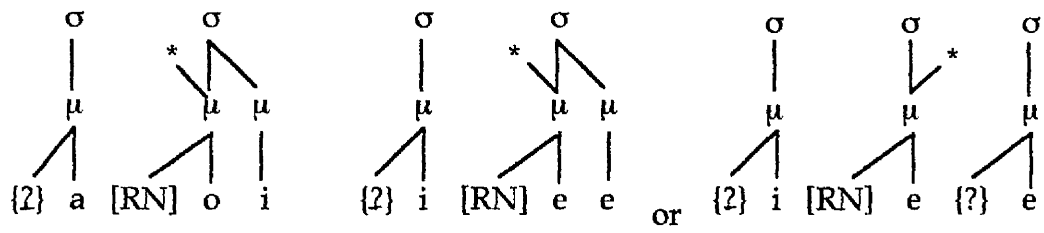
[49] However, the stem is not necessarily accented, e.g., $at\overset{*}{u}\text{-}i$ 'hot'. After the adjective formative suffixation, in most cases an accent is carried by a mora which precedes the mora associated with the adjective formative *i*. I.e., this is not always applicable for all adjectives. For example, *atu-i* 'thick' is not accented.

As a consequence, the accent is located on the first mora of each case. Structures for *aoi* and *iee* are depicted in (65).

(65)

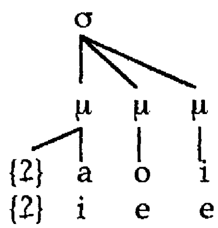
a. b.



({ } indicates an epenthetic segment)

Another possible syllabification for *aoi-i* and *ie-e* could be available provided that these cases are treated as marked and the constraint on the accent bearer is maintained (see the previous paragraph).[50] Thus a trimoraic (super-heavy) syllable would be employed, and the two words would be syllabified as illustrated in (66).

(66)



To sum up this subsection, I shall represent the syllabification of the sentence *'Watasi-wa ao-i ie-e itta'* as : wa.ta.si.wa. {ʔ}a.[RN]oi. {ʔ}i. [RN]ee. {ʔ}it.ta. or as wa.ta.si.wa. {ʔ}a.[RN]oi. {ʔ}i.[RN]e.{ʔ}e. {ʔ}it.ta. Not only does no segment remain unsyllabified, but also no violation of the maximum number of morae per syllable is seen in either syllabification. Alternatively, by employing a trimoraic syllable, two words *ao-i* and *ie-e* could be syllabified into a trimoraic syllable provided that the constraint on the possible accent bearer is maintained.

[50] In a monomoraic syllable, the single, only, mora can be interpreted as the first mora, thus it can escape from this constraint (see also 5.3.3.2.3.2).

Chapter 3
KiMvita - I

3. 0 Introduction

This chapter and Ch. 4 concern the phonology of KiMvita Swahili. The primary intention of the research is to consider the nature of the moraic nasals; however, it has also been felt that it is essential to deal with some other aspects, such as Nasal+Consonant (N+C) sequences and Consonant+Glide (C+G) sequences.[1] Discussion of the N+C sequences is important for comparison between the behaviour of the moraic nasals and the prenasalized consonants (stops and fricatives), which is made in chapter 4. The existence of prenasalized fricatives and certain variations found in the pronunciation of C+G sequences will lead to a revision of the proposed inventory of consonant phonemes considered at the beginning of this chapter. Thus, the two sequences, N+C and C+G, will be dealt with in distinct chapters, although, ideally, they should be discussed in closer connection to each other. However, both types of sequence are intimately involved in syllabification-related processes, which will be looked at in Chapter 4.

In this chapter, I shall initially present an already-published account of the consonant phonemes, and then argue for a revised inventory based on certain pronunciation facts, which is preceded by some back ground information concerning this dialect. The inventory of syllable types and the rule of stress assignment are also matters to be examined. They will be discussed from the viewpoint of moraic phonology, and I will claim that KiMvita phonology allows bimoraic syllables, that stress assignment is calculated in terms of morae, and that the stress bearer is the mora - contrary to claims found in previous work, in which the syllable is regarded as the stress bearer.

It is necessary to say something about the transcription employed. Since no official Romanized orthography is recognized for KiMvita, when examples are cited, a phonemic transcription is employed. However, in a later section of this chapter, the inventory of consonant phonemes advanced by Yahya Ali

[1] The term 'glide' (G) should be understood as a shorthand for a 'high vocoid' (see 1.2.4.3.2).

Omar and Frankl (1997, 1998) will be revised, and, as a consequence, the voiced implosive stop symbols, /ɓ, ɗ̪, ɗ, ʄ, ɠ/ employed by the above authors, are replaced with /b, d̪, d, ɟ, g/. According to Yahya Ali Omar and Frankl (1997, 1998), the following chart gives a phonemic transcription and a corresponding Romanized orthography appropriate for KiMvita. Although the Romanized orthography set out in their proposal seems to be considered appropriate for KiSwahili in general, it is employed only for representing words from Standard Swahili in this thesis. In (1), column A shows the phonemes, where phonemes in brackets represent items not found in Standard Swahili, while the corresponding letters of the Romanized orthography are exhibited in column B.

(1) KiMvita phonemes and Romanized Orthography

A	B	A	B	A	B
a	a	k^h	k	t	t
b	b	χ	kh	t^h	t
t͡ʃ	ch	l	l	θ	th
t͡ʃ^h	ch	m	m	u	u
(d̪)	d	n	n	v	v
d	d	ŋ	ng'	w	w
ð	dh	ɲ	ny	y	y
e	e	o	o	z	z
f	f	p	p	^{N}b	mb
g	g	p^h	p	(^{N}d̪)	nd
ɣ	gh	r	r	^{N}d	nd
h	h	s	s	^{N}d͡ʒ	nj
i	i	ʃ	sh	^{N}g	ng
ɟ	j	(t̪)	t		
k	k	(t̪^{h})	t		

3. 1 General Background concerning KiSwahili

The first two sections will briefly sketch out something of the history of KiSwahili and its classification. Following these sections, the relation between Standard Swahili and KiMvita will be outlined.

3. 1. 1. History

On the East African coast, the history of the Sabaki[2] speakers's relationship with Arab settlements goes back to the 7th century. Since that time Arab settlements developed along the coast, and accordingly the influence of Arabic culture and religion started growing among the Bantu people. Their language was also influenced by the Arabic language. Around the 13th century, a distinct 'Swahili' language was born out of this prolonged exposure to the Arabic language (See Haddon 1955, Goto 1972, Goyvaerts 1978); though Nurse and Spear (1985: 15) state that it was not until the 18th century that Arabic vocabulary influenced the Swahili language intensely.

3. 1. 2 Classification

According to every classification of African languages (see Greenberg 1963, Goyvaerts 1978, Ruhlen 1987), it is universally accepted that KiSwahili is a member of the Bantu language family. Based on Greenberg (1963) and Bennett and Sterk (1977), Ruhlen (1987) notes that Bantu in turn belongs to the Benue-Congo group, which is itself a subdivision of the Niger-Congo group; this latter belongs to the Niger-Kordofanian phylum, one of the four major groups of African languages.

KiSwahili is spoken as a mother tongue over a widespread area: the coastal area and neighbouring islands of Kenya and Tanzania; the coast area and interior of the extreme south of Somalia; the coastland of Mozambique. KiSwahili is also spoken as the second language or as a lingua franca on the periphery of the KiSwahili-speaking area, but until the second quarter of the 20th century, Standard Swahili did not exist. Since then, however, Zanzibar Swahili came to be developed as the standard form of Swahili (see Haddon 1955: xiii-xiv, Whitely 1969: 80, Goto 1972: 10, Goyvaerts 1978: 165, Polomé 1980: 86).

With respect to the Swahili dialects, which are spoken in Somalia, Kenya, Tanzania and a part of Mozambique, they are divided into three groups (Nurse and Hinnebusch, 1993): (i) Northern Dialects (ND), which are found from Somalia to just south of Mombasa; (ii) Southern Dialects (SD), which cover the southern area from KiVumba spoken in Shimoni, Vanga, etc.; (iii) dialects that

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[2] 'Sabaki' is a linguistic label for six related languages of the East African coast: Swahili, Mwani, Elwana, Pokomo, Mijikenda, and Comorian (see Nurse and Hinnebusch 1993).

are neither ND nor SD, such as Chifundi, spoken from the Mkurumuji River, south of Gazi, to the Ramisi River in southern Kenya. From this classification of Swahili dialects, it is clear that KiMvita, Mombasa Swahili, is one of the Northern Dialects. However, since this thesis is not concerned to any great extent with different characteristics seen between the dialects, these observations should be only regarded as information concerning where KiMvita stands as one of the Swahili dialects.

3.1.3 KiMvita

In this section, a particular dialect of Swahili, KiMvita, will be looked at. There is no doubt that KiMvita as a member of the Bantu language family continues most of the salient properties of the Bantu languages, and as a one of the Swahili dialects it also shares many features with Standard Swahili. Its vocabulary has been expanded by the great influence of Arabic (Islamic) culture. The more recent influences of some European languages, such as English, have also enriched its vocabulary.

One of the major characteristic features of KiMvita is the loss of the Proto-Sabaki affricates. Thus, both the voiced and voiceless affricates when preceded by prenasalization are realized respectively as the voiced prenasalized and voiceless aspirated dental stops, i.e., * ᴺd͡ʒ > /ᴺd̪/ and * ᴺt͡ʃ > /t̪ʰ/, in KiMvita.[3] The voiced prenasalized affricates and the voiceless aspirated affricates are however retained in some other dialects (see Nurse and Hinnebusch 1993: 153-155 and 159-161).[4]

Another characteristic feature of KiMvita is the voiceless aspirates. As Polomé (1967: 40) states; "... aspiration as a distinctive feature to contrast two lexical items seems to have been better preserved in the northern area, e.g., Mombasa...". This feature is also not found in Standard Swahili. Thus, the word /paka/ [paka] (V) 'paint' contrasts with the word /pʰaka/ [pʰaka] (N. 9/10) 'cat' in KiMvita, whereas the word *paka* [paka] means both 'paint' and 'cat' in Standard Swahili.

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[3] This dentality is also found in some other dialects (see Bakari 1985, Nurse and Hinnebusch 1993).

[4] However, there are some exceptions. The voiced prenasalized affricate and the voiceless aspirated affricate are actually found in KiMvita: for example, /ᴺd͡ʒema/ (A) 'good (with a Cl. 9/10 noun)' and /t͡ʃʰuᴺvi/ (N. 9/10) 'salt' respectively (see 3.3.3).

Apart from certain characteristic features, including the two described above[5], it can generally be said that the phonology of KiMvita is similar to that of Standard Swahili. Therefore, discussion based on KiMvita phonology in this thesis will overlap with the phonology of Standard Swahili to some extent, and I believe that arguments and conclusions advanced here would also hold for Standard Swahili.

The salient properties of KiMvita seem now to be preserved by only a limited number of speakers. My informant, Sheikh Yahya Ali Omar (hereafter abbreviated to Sh. Yahya), is one of them; he is probably a member of the last generation of KiMvita speakers. In Mombasa, people tend to speak Standard Swahili more and more nowadays (see Yahya Ali Omar and Frankl 1998: xi-xii).

3. 2 The Structure of KiSwahili (KiMvita)

Two of the major characteristic features of the phonology of KiMvita, as has been mentioned, are dental stops and aspiration. In this section, some general structural properties of KiSwahili will be outlined. They are also characteristic of KiMvita. The Romanized orthography presented for Standard Swahili in (1) is utilized in this section.

3. 2. 1 Characteristics of KiSwahili

It is natural to assume that a language family shares a fairly large number of characteristics among its member languages: this is also the case in KiSwahili. KiSwahili, as a member of the Bantu language family, shares certain characteristics of the Bantu language. Goyvaerts (1978: 166-7) lists some structural features which are widely shared by members of the Bantu language family. Among these, apart from the noun class system (cf. 3.2.2), there are four features:

(a) A seven- or a five-vowel system is found in most Bantu languages. Proto-Swahili, like Proto-Bantu, contained seven vowels, however, as a result of the merger of two pairs of high vowels, */i, ɪ/ and */u, ʊ/, in present KiSwahili, there is a five-vowel system: /i, e, a, o, u/;[6]

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[5] See Polomé (1967) and Bakari (1985) for details.

[6] See Clements (1991b), and Nurse and Hinnebusch (1993), among others.

(b) every syllable ends in a vowel (i.e., open syllables);

(c) most members of the Bantu language family are said to be tone languages;

(d) there is a common verbal structure: a verbal root is affixed by an agglutination of various components: subject prefix - tense morpheme - (object morpheme) - verbal root - (stem extension) - verb final vowel, for example, *a* - *ta* - *pik* - *a*

s/he will cook final vowel 's/he will cook'.[7, 8]

The features (a) and (d) are found in KiSwahili. However, while words of Bantu origin comply with the open syllable feature (with possible exceptions such as *tamka* and *amka*), words of Arabic origin also allow a closed syllable. Most Swahili dialects including KiMvita as well as Standard Swahili lost characteristic of (c) and are now recognized as stress languages.[9]

3. 2. 2 The Noun Class System

The noun class system with its concord prefixes is one of the major features of the Bantu languages. However, the number of noun classes varies among the languages in the family. For example, in the Proto-Bantu language, nouns were divided between nineteen to twenty-one classes indicated by the form of the prefixes carried (see Guthrie 1967 - 71 Vol. I - IV, Meinhof 1932).[10] This division was based to a large extent on semantic distinctions. However, the present-day Bantu languages have lost most of the semantic correlations that characterized the classes originally. Goyvaerts (1978: 168) states; "... with the exception of class 1/2 (*m-/wa-*) there is no correspondence between any one class and (any) [sic] semantic feature".

The following chart illustrates the noun classes in KiSwahili. I shall cite the forms of the noun class prefixes according to Meinhof (1932: 128), Polomé (1967: 94-95) and Goyvaerts (1978:171).

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[7] In verb formations, I shall use the terms 'stem' and 'root', which refer to a verb form including final vowel and that without final vowel or extensions respectively; for example, *pika* is a stem while *pik-* is a root.

[8] In KiMvita, the consonant *t* of *ta* is dental, thus /t̪a/.

[9] ChiMwiini, one of the Swahili dialects, which is spoken in Somalia, maintains tone language characteristics.

[10] Welmers (1973: 165) counts the Proto-Bantu noun classes as twenty-three.

(2)[11]

Noun Classes	Meinhof		Polomé		Goyvaerts
1.	m-, mw-		{m}		m-, mu-, mw-
2.	wa-		{wa}		wa-
3.	m-, mw-		{m}		m-, mu-, mw-
4.	mi-		{mi}		mi-
5.	-, (dji-)[12]		{ɟi}		ø, ji-(=[ɟi])
6.	ma-		{ma}		ma-
7.	ki-		{ki}		ki-,ch-(=[č])
8.	vi-		{vi}		vi-, vy-
9.	ń, n-, m-		{n}		ø, N-
10.	ń, n-, m-		{n}		ø, N-
11/14.	u-, m-		{u}{m}	11.	u-
14.	—		—		u-
15.	ku-	15/17.	{ku}	15.	ku-
16.	pa-		{pa}		pa-
17.	ku-		—		—
18.	m-		({mu})[13]		—

The chart in (2) shows that the noun classes 12, 13, 19, 20, and 21 do not occur in KiSwahili. Hence, the Swahili noun classes are generally reckoned as sixteen; i.e., Proto-Bantu classes 1 to 11 and 14 to 18. The division into noun classes varies among scholars, especially in the case of nouns from classes 11 to 18. For example, Meinhof (1932) and Polomé (1967) merge class 14 with class 11, and Polomé merges class 17 with class 15,[14] while Goyvaerts (op. cit.) operates with classes from 1 to 16 with a lack of classes 12 and 13. However, since this thesis is mainly concerned with nasal prefixes, which occur especially in classes 1, 3, 4, and 9/10, other classes are of less interest (except for Cl. 7, 8, and 15 for discussion of possible C^G phonemes).

Although the noun classes could not fully be classified according to semantic features, the noun classes 1, 2, 3, 4, 9, and 10 may be characterized as follows: (i) Classes 1 and 2 designate humans with two exceptions (*mdudu/wadudu* 'insect', and *mnyama/wanyama* 'animal'); (ii) Classes 3 and 4 designate in a general way plants or trees; (iii) various types of nouns are found

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[11] Representation of noun class prefixes follow the notation used in sources.

[12] Meinhof (1932: 128) states that 21 *dji* - no longer occur as an independent prefix. All words in this class are treated as if it were Cl. 5, e.g., *dji-ti* (N. 5) 'big tree'.

[13] Polomé treats noun prefixes and pronominal prefixes separately

[14] Goto (1972) and Welmers (1973) follow the same lines of division as Meinhof.

in Classes 9/10, which may well be regarded as the default class of the system; it contains, for example: nouns denoting both inanimate and animate items, some abstract concepts, and loanwords.

Classes 1, 3, and 9 contain singular forms and their plural counterparts are found in Classes 2, 4, and 10 respectively. However, Classes 9/10 do not distinguish formally between singular and plural forms. The prefixes of these classes are shown in (3).

(3)

Classes	Singular	Plural
Cl. 1/2	m- ~ mw- ~ (mu-)[15]	wa-
Cl. 3/4	m- ~ mw- ~ mu-	mi-
Cl. 9/10	N- ~ ny- ~ ø-	N- ~ ny- ~ ø-

The Cl. 9/10 prefix N- indicates a homorganic nasal, and therefore its realization depends on the following consonant. Regarding prefix alternants, a prefix *mw-* or *mu-* occurs with vowel-initial stems belonging to Cl. 1 or Cl. 3, and *ny-* occurs with vowel-initial stems in Cl. 9/10. For example, *mw-ana* (N.1) 'son/daughter', *mw-aka* (N. 3) 'year', and *ny-oka* 'snake' (N. 9/10). Furthermore, a few stems beginning with *h,* which are found in Cl. 3, take a prefix *mu-*; for example, *mu-hogo* 'cassava' and *mu-hindi* 'Indian corn plant'.[16]

3. 2. 3 Phonological Environments where Moraic Nasals Occur

Moraic nasals are found not only in the noun prefixes just seen above, but also in certain other morphemes. Among the Swahili dialects, they are found in the ten different environments below.[17] However, in Standard Swahili, moraic nasals are found in environments (i), (ii), (v), (vi), (viii), and (ix), while in other environments, moraic nasals are not usually realized, though they might occur in rapid speech. Note that the two major characteristics of phonology in KiMvita, dentality and aspiration, are not specified here.

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[15] The alternative prefix /mu-/ is found in KiMvita. Although only in limited cases, the alternative prefix /mu-/ is found for words derived mainly from vowel-initial verbs and perhaps also from vowel-initial noun stems; e.g., /mu-a^{N}d̪iʃi/ (N. 1) 'writer' ← /a^{N}d̪ika/ (V) 'write', /mu-e^{N}be/ (N. 3) 'mango tree' ← /e^{N}be/ (N. 5) 'mango', etc. In addition, /muhi^{N}d̪i/ (N. 1) 'Indian person' is found in KiMvita (cf. the same word having a different meaning to the above).

[16] Compare with nouns in Cl. 1 derived from a verb, which take a prefix *m-*, for example, *m̩himili* 'patient, enduring person' ← *himili* 'bear, endure'.

[17] See also Tucker and Ashton (1942: 99-100).

(i) Cl. 1 and 3 nasal prefixes for N's and A's: *m-*

The prefix in Cl. 1 & 3, *m-*, is derived historically from **mu-*, and takes a consonant-initial stem. This derivation occurred as a result of vowel dropping, and the nasal *m* becoming moraic.

E.g.,	m-toto	[m̩]toto	(N. 1)	'child'
	m-kate	[m̩]kate	(N. 3)	'loaf of bread'
	m-pya	[m̩]pya	(A with N.1/3)	'new'

(ii) Cl. 9/10 nasal prefix for N's and A's: *N-*

The prefix in this class when present is normally realized as a part of various prenasalized stops (and fricatives). Only when the stem itself is monomoraic, is the nasal prefix moraic, and then it bears stress. A moraic nasal appears to have the same place of articulation as the following consonant.

E.g.,	N-ge	[ŋ̩́]ge	(N. 9/10)	'scorpion'
	N-chi	[ń]chi	(N. 9/10)	'country'
	N-pya	[ḿ̩]pya	(A with N. 9/10)	'new'

(iii) 1st sg. subject verbal agreement: *ni-*

When *ni-* is followed by a consonant-initial morpheme the *i* may drop,[18] and then the *n* is realized as moraic.

E.g., ni - li - penda → [n̩] ~ [ni] - li - penda [19]
I past love
tense
'I loved'.

(iv) 1st sg. object verbal agreement: *ni-*

The process is the same as in (iii).

E.g., a - li - ni - tukana → a - li - [n̩] ~ [ni] - tukana[20]
s/he past me insult
tense
's/he insulted me'.

[18] When a vowel-initial morpheme follows *ni-*, dropping of *i* never occurs, and *ni-* remains intact, for example, *a - li - ni - alika*, but **a - li - n - alika* 's/he invited me'.

[19] In KiMvita, the word *penda* contains dental *nd*; viz., /pe[n̪d̪]a/.

[20] The consonant *t* of *tukana* is dental in KiMvita; thus /t̪ukana/.

(v) 2nd pl. subject verbal agreement: *mu-*

When *mu-* is followed by a consonant-initial morpheme the *u* may drop, and then *m* is realized as moraic.

E.g., mu - li - penda → [m̩] ~ [mu] - li - penda
you past love
(pl.) tense 'you (pl.) loved'

(vi) Cl. 1/3rd sg. object verbal agreement: *mu-*

The process is the same as in (v).

E.g., ku - mu - piga → ku - [m̩] - piga
Cl. 15 him/her beat 'to beat him/her'
prefix

(vii) Present tense affirmative copula: *ni*

ni is a clitic element that attaches to a following noun phrase head. The process is the same as in (iii).

E.g., huyu - ni - ng'ombe → huyu - [n̩] ~ [ni] - ng'ombe
this is cow 'this is a cow'

(viii) Various lexical items

Within lexical items, when a nasal is followed by any consonant except for a voiced stop or a voiced fricative, *m* or *n* is always realized as moraic.

E.g., *namna* 'type', *tamka* 'pronounce', *nne* 'four', *binti* 'daughter', etc.

(ix) Cl. 18 locative prefix : *mu-*

The prefix *mu-* expresses the concept of interior location. The process is the same as in (v).

E.g., kikapuni - mu - na - viazi → kikapuni - [m̩] ~ [mu] - na - viazi
basket in be potatoes 'some potatoes are in the basket'

(x) Perfective tense morpheme: *me-*

The perfective tense morpheme *me-* becomes moraic when followed by a consonant-initial morpheme, and the moraic nasal appears to share the same place of articulation with the following consonant.[21]

E.g. a - me - paka → a - [m̩] - paka
s/he perfective paint 's/he has painted'

a - me - soma → a - [n̩] - soma
s/he perfective read 's/he has read'

For plural forms of Cl. 11 (the singular noun prefix is *u-*), the Cl. 9/10 prefix *N-* is used.[22] However, in the case of the monomoraic stem words, a plural prefix is affixed to the singular form, so there would be no moraic nasal to be realized; e.g., *u-wa* 'court yard' vs. *ny-u-wa.* (pl.).[23] Moreover, when an adjective modifies a singular form of a noun in Cl. 11, the prefix *m-* or *(mw-)* is employed while in the case of a plural form, the prefix *N-* is employed. For example, *u-bao m-refu* 'long board' (sg.) vs. *N-bao N-defu* 'long boards' (pl.).[24]

3. 3 The Inventory of Phonemes in KiMvita

3. 3. 1 The Inventory of Vowel Phonemes in KiMvita

While some other Bantu languages keep the original seven-vowel system, in the group to which KiSwahili belongs it was reduced to five (see 3.2.1). Thus the inventory of vowel phonemes in KiMvita is /i, e, a, o, u/.

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[21] In KiMvita, the perfective tense morpheme appears to be the nasal component of a prenasalized obstruent when the following morpheme begins with a voiced obstruent; for example, /a - me - baki/ → /a - [^{m}b]aki/ 's/he has remained'. Thus, the perfective tense morpheme is considered to be /N-/ in KiMvita (Sh. Yahya, personal communication, and see also Nurse and Hinnebusch (1993: 518)).

[22] The plural prefix of Cl. 6 *ma-* is used for some words, for example, *ugonjwa* (sg.) 'disease' vs. *magonjwa* (pl.) 'diseases'.

[23] This spelling is also found in KiMvita and KiTikuu (see Sacluex 1939); however *ua* is found in Johnson (1939).

[24] In the plural form, the liquid consonant *r* of the adjective *refu* 'long' becomes *d* by undergoing nasal fortition; i.e., that the consonant *r* loses its [continuant] feature, but the [stop] feature of the preceding nasal spreads to the consonant *r*, and as a consequence, a non-continuant homorganic prenasalized stop [^{n}d] is realized. This phenomenon also happens to the liquid *l* and the glide *w* in KiMvita (Swahili). However, this occurs in very limited number of cases (see Polomé 1967: 69-70, Herbert 1986: 237-238 for details).

3. 3. 2 The Revision of the Inventory of Consonant Phonemes in KiMvita

The phonetic realization of C+Glide sequences obtained from the pronunciation of my informant raises a question as to whether or not the inventory of consonant phonemes in KiMvita advanced by Yahya Ali Omar and Frankl (1997, 1998), given in (4), is really adequate. Regarding the term 'glide' (abbreviated to G), as has been noted in 1.2.4.3.2, it should be interpreted as '(pre-vocalic) high vocoid' and hence 'w' and 'y', as well as 'G', are understood to be shorthand forms of 'high back round vocoid' and 'high front vocoid' respectively.

(4)

		labials	dentals	alveolars	palatals	velars
Stops:	plain	p	t̪	t	t͡ʃ	k
	aspirate	p^h	t̪^{h}	t^h	t͡ʃ^h	k^h
	implosive	ɓ	ɗ̪	ɗ	ʄ	ɠ
	pre-nasalized	^{N}b	^{N}d̪	^{N}d	^{N}d͡ʒ	^{N}g
Fricatives:	voiceless	f	θ	s	ʃ	(χ)/h[25]
	voiced	v	ð	z		ɣ
Nasals:		m		n	ɲ	ŋ
Liquids:	lateral			l		
	vibrant			r		
Glide:		w			y	w

(Yahya Ali Omar and Frankl 1997: 62)[26]

As can be seen in (4), a palatal nasal, /ɲ/, which corresponds to *ny* orthographically in terms of Standard Swahili, is already regarded as a phoneme. However, we find that most consonants may be followed by w-/y-glides in KiMvita (and Standard Swahili). This fact requires a thorough investigation as to the possibility of there being C^w/C^y phonemes, i.e., labialized-velarized/palatalized consonants. In addition to this, certain prenasalized fricatives, [^{m}v] and [^{n}z], also require examination. Indeed, all

[25] The two sounds [χ] and [h] are produced at uvula and glottis respectively, and the actual pronunciation of /χ/ depends upon the degree a speaker is influenced by Arabic pronunciation. Some speakers pronounce the sound [χ], while others replace it with [h], which is found in KiMvita natively. Yahya Ali Omar and Frankl put /χ/ and /h/ into the velar group. This seems simply to be for ease of exposition.

[26] In the works of Polomé (1967) and Bakari (1985), similar consonant phonemes are put forward. However, Polomé does not include prenasalized stops and Bakari does not include aspirated voiceless stops.

possible prenasalized obstruents will be reconsidered in 3.3.3 as to whether or not they should be regarded as phonemes.

3. 3. 2. 1 Voiced prenasalized fricatives

Discussion of the two prenasalized fricatives is straightforward; however, the discussion here is to investigate whether or not the present phoneme inventory should include them. A contrast between prenasalized voiced fricatives and simple voiced fricatives is found in the lexicon, e.g., /ʊtomvu/ (N. 11) 'thick viscid sap' vs. /kɪtovu/ (N. 7) 'navel', and /anza/ 'begin' vs. /azali/ 'without beginning (used for the God)'. Words found in Cl. 9/10 provide the general distribution of other prenasalized fricatives, viz., word-initial ones; for example, /N-vua/ [^{ɱ}vua] 'rain', /N-zige/ [^{n}ziʄe] 'locust', etc. Moreover, stress is never realized on /m/ or /n/ in words such as /ʊtomvu/ or /anza/, which is strong evidence that /mv/ and /nz/ sequences should be regarded as unitary sounds (cf. 3.5 where we will see coda nasals do bear stress). Hence, two prenasalized voiced fricatives, [^{ɱ}v] and [^{n}z], have to be considered as phonemes, /^{N}v/ and /^{N}z/, in the present inventory. However, as mentioned above, theories that this study employs require a thorough investigation on the phonemic status of two newly considered prenasalized voiced fricatives as well as the existent prenasalized stops.

3. 3. 2. 2 C+Glide sequences in KiMvita

Unlike the prenasalized fricatives, decisions about the phonemic status of Cw and Cy will not be so straightforward. Two types of C+G sequences, Cw and Cy, will be considered based on their phonetic realization as found in various forms, such as when noun prefixes are followed by a vowel-initial stem and when passive/causative suffixes follow verb roots. We shall also need to examine stems of N(oun)s, V(erb)s, and A(djective)s. It is important to note that a glide, which is a shorthand for a high vocoid, is specified as having a [S] feature in this study; thus a sequence of C+G is understood to be [C, (S)][S]-[high] underlyingly.

The C+G sequences are found both within morphemes and across morpheme boundaries. The former includes N/V/A stems, and certain adverbs; for example, /t^{h}wiga/ (N.9/10) 'giraffe', /amwa/ (V) 'suck the breast (said of a baby)'[27], /pya/ (A) 'new', etc. In the latter, a C+G sequence is created

[27] In Johnson (1939), *nyonya* has this meaning.

when a noun prefix precedes a vowel-initial stem in Cl. 1, 3, 4, 8, (9/10),[28] 15, 17 and 18, for example /mw-a^{N}ga/ (N.1) 'werewolf', /kw-e^{N}da/ (N.15) 'to go', /vy-oo/ (N.8) 'toilets', and so on.[29] Likewise when a passive suffix /-w/ or a causative suffix /-y/ appears in the final C+a sequence of a verb, a C+G sequence is found; for example, the passive suffix /-w/ appears after the final consonant of a verb root /m/ of /kam-a/ 'milk', hence /kam-w-a/ 'be milked'.[30, 31] In addition, prepositions and associative forms also contain C+G sequences; for example, /kwa/ 'with' and /vya/ as in /vit̪abu vya watoto/ 'children's books'. Furthermore, in the post-lexical phonology (see 3.3.2.3), when a pronoun /mu-/ (2nd pl. sb.) or /tu-/ (1st pl. sb.) precedes a vowel-initial tense morpheme /a-/ (simple present), it is realized as /mw-/ or /tw-/; for example /ɲiɲi-mw-a-soma/[32] (← /mu-a/) 'You are reading' or /sisi-tw-a-a^{N}d̪ika/ (← /tu-a/) 'We are writing'.[33]

Thus, Cw and Cy sequences are found in the following environments, where (5f) is found in the post-lexical phonology

(5)

a.	Stems in N/V/A:	Cw	Cy
b.	Prefixes of Cl. 1, 3, 15, 17 and 18:	Cw	—
c.	Prefixes of Cl. 4, 8, (9/10):	—	Cy
d.	Passive forms:	Cw	—
e.	Causative forms:	—	Cy
f.	Pronouns (1st, 2nd pl. sb/1st pl., 3rd sg. obj)	Cw	Cy
g.	prepositions / associative forms:	Cw	Cy
h.	adverbs:	Cw	Cy

---

[28] Since the noun prefix of Cl. 9/10 for vowel-initial stem, /ɲ/, is already regarded as a phoneme, listing 'Cl. 9/10' among other noun classes is simply to be seen as information as to where a CG sequence may be found. This is also true to stems in N/V/A containing /ɲ/.

[29] The prefixes of Cl. 17 and 18, /ku-/ and /mu-/ also become /kw-/ and /mw-/ before a vowel-initial morpheme, for example, /kwa^{N}gu/ 'my' and /mwa^{N}gu/ 'my' respectively.

[30] The causative suffix /-y/ is used only when a final consonant of a verb root is /n/, /p/, or /w/. In the cases of /p/ and /w/, /pya/ and /wya/ undergo phonological processes of lenition and fortition respectively and are realized as /fya/ and /vya/ respectively. For example, /kana/ → /kaɲa/ 'forbid', /bopa/ → /bofya/ 'cause to press a soft surface such as fruit', and /lewa/ → /levya/ 'make drunk'. Otherwise, the causative suffixes are /-ʃ/ and /-z/.

[31] In KiMvita, the meaning of the word /kama/ is limited to 'squeeze for milking'.

[32] 'You (pl.)' in KiMvita is /ɲiɲi/, not *ninyi* as in Standard Swahili.

[33] When an object pronoun /tu-/ '1st pl.', /ku-/ '2nd sg.', or /mu-/ '3rd sg.' is followed by a vowel-initial verb stem, it retains the vowel /u/ and creates a vowel sequence with a following vowel; no light diphthong is heard. For example, /ɱ-li-t[u-o]na/ 'You (pl.) saw us', /ŋ-li-k[u-a]^{N}d̪ikia barua/ 'I wrote a letter for you (because, you cannot write)' or /ŋ-li-m[u-a]lika/ 'I invited him'. The translation of the second sentence can only be this for KiMvita unlike Standard Swahili, in which 'I wrote a letter to you' is also available (see also 4.2.3.1).

In the environment of (5b), a prefix /mw-/ or /kw-/ precedes a vowel-initial stem in Cl. 1 and 3, or in Cl. 15 respectively. Some vowel-initial stems found in Cl. 4 or Cl. 8 follow respectively a prefix /my-/ or /vy-/, however, as will be seen in later sections (3.3.2.5.1 and 3.3.2.5.2), some vowel-initial stems do not take a prefix /my-/ or /vy-/.

Both Cw and Cy sequences are found in various environments, however, discussion about the need to recognize possible C^w/C^y phonemes focuses on items found in the environments (5a. b. c. d. e); it omits consideration of the prefixes of Cl. 17 and 18 and items found in the environments specified (5f, g, h) are also excluded from discussion for reasons of space. It should also be noted here that a discussion of C+G sequences always involves a following vowel, and therefore it will be shown when necessary.

The words/affixes containing Cw or Cy sequences were first selected from Johnson's (1939) dictionary, which is not based on KiMvita. Then, on the basis of the data obtained from the dictionary, C+G sequences actually found in KiMvita were checked with my informant.[34] The following chart shows the actual C+G sequences found in KiMvita.

(6) C+G sequences found in KiMvita[35, 36]

pw	t̪w	tw	tʃw	kw	py	
p^{h}w		t^{h}w		k^{h}w		
bw			ɟw	gw		
^{N}bw	^{N}d̪w	^{N}dw	^{N}dʒw	^{N}gw		
		sw ʃw			fy	fyw
		zw			vy	vyw
		^{N}zw			^{N}vy	
mw		nw	ɲw		my	
ŋ͡mw						
		rw				

The glides exhibit three different phonetic realizations, involving both consonantal and vocalic characteristics. Thus, although they are symbolized as

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34 This method might seem to be inadequate; however, it proved to be the most efficient in terms of the time and energy of my informant.

35 Sequences *mvy* and *fw* are found in words *mchamvya* (N. 3) 'another name for *mchocha* - tree with yellow edible berries' and *shufwa* (N. 11) 'even number' (see Johnson 1939); the latter is found in KiUnguja (Standard Swahili) according to Ahmad Kipacha, a speaker of the language. However, these words seem not to exist in my informant's lexicon, and I therefore exclude the sequence from the chart.

36 Standard Swahili seems also to have sequences of *lw* and *dw* (see Johnson 1939).

/w/ and /y/, their phonetic transcriptions would include also vocalic symbols. Three different phonetic realizations are given in (7) in a generalized way. These vary on the basis of the location of the stressed vowel, as we will see shortly in discussion of possible C^G phonemes, and that of a glide itself.

(7) Three different phonetic realizations of the glides

	/w/	/y/
a.	[C^w]	[C^j]
b.	[CŭV]	[CĭV]
c.	[wV]	[jV]

(7a) indicates a glide which has become a secondary articulation of the preceding consonant. This occurs when a stressed vowel immediately precedes a C+G sequence. The glide is realized as a component of a light diphthong elsewhere, as in (7b). Finally, in (7c), a glide is realized as an onset consonant; this happens when it begins a syllable.

The discussion of the possible C^G phonemes will employ the ideas of Lexical Phonology, advanced by Kiparsky (1982a, b) and Mohanan (1982), to account for distinctions in terms of the nature of underived and derived items. A brief sketch of the theory is presented in the following section, and this is followed by discussion of the Cw and Cy sequences in sections 3.3.2.4 and 3.3.2.5 respectively.[37]

3. 3. 2. 3 Lexical Phonology

In this section, I shall briefly outline the theory of Lexical Phonology (see Kaisse and Shaw 1985, Pulleyblank 1983, Goldsmith 1990, Kenstowicz 1994).

Two components figure prominently in the theory of Lexical Phonology (LP): a lexical component and a post-lexical component (or phrasal phonology). Rules which may apply within the lexicon belong to the lexical phonology, while those which may apply to the outputs of the lexical phonology, i.e., in syntactic constructions, arise in the post-lexical phonology. Theoretical constraints and conditions such as 'Underspecification', 'the Elsewhere Condition', 'Structure Preservation', 'the Strict Cycle Condition', etc. are important concepts within LP.[38] Among these, however, the idea of 'Strata'

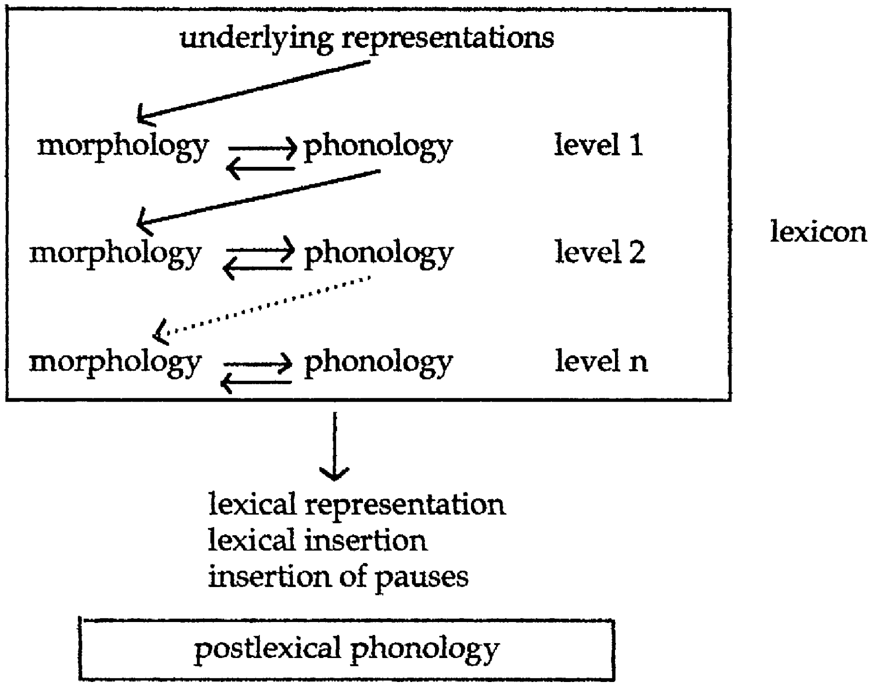
[37] Lexical Phonology is also employed in accounting for whether or not a vowel sequence undergoes Light Diphthong Formation, which will be dealt with in 4.2.3.1.

[38] Since this thesis does not employ the theory of Lexical Phonology in its entirety, I would not wish to go further. Interested readers should consult the references cited above and Rubach (1984), Halle and Mohanan (1985), and Kiparsky (1985), among others.

(synonymous with 'Levels' or 'Layers') in the lexicon would be the most relevant one in accounting for justification of the 'underived' status of items such as passives, causatives, etc., in KiMvita.

The interaction between morphology and phonology within LP can be shown in a chart, as in (8).

(8) Strata



(Kaisse and Shaw 1985: 9)

The chart (8) shows that each level (stratum) contains an affixation process (morphology) and phonological rules (phonology). Each stem undergoes certain morphological processes together with the appropriate phonological rules at that level. In each stratum only one set of affixation processes takes place, and the output of each level, which is itself a lexical item, goes to the next, where a similar cycle is repeated. The last output produced at level *n* goes to the post-lexical phonology.

Application of LP to KiMvita regarding a discussion of the possible C^G phonemes will be considered in 3.3.2.4.3; however, it will be revised in 4.2.3.1. The ideas of LP will also be employed in the case of vowel-initial morphemes in Japanese (see 5.3.2.2.2).

3. 3. 2. 4 The Cw sequences

In this section, the Consonant+high round back vocoid (abbreviated as Cw) sequences are investigated. As shown in (5) above, Cw sequences are found in a variety of environments. Among the occurrences of Cw sequences, the sequences /kw/ and /mw/ appear more in words and morphemes than other sequences do. For example, only quite minimal occurrences are found for the sequences /ɟw/, /ndʒw/, /nzw/, /ɲw/ and so on. Moreover, sequences such as /ɟw/ and /zw/ appear to be found only in passive forms, i.e., across a morpheme boundary. While these occurrences should not be disregarded, my initial concern will be observation and discussion of /mw/ and /kw/ sequences, which many words contain. In the following subsections, a classification of /mw/ and /kw/ sequences are undertaken based on their phonetic realization. Subsequently, possible phonemic analyses will be discussed.

3. 3. 2. 4. 1 /mw/ sequences

The /mw/ sequences found in Cl. 1 and 3 prefixes, stems, and passive forms exhibit three different phonetic realizations; the glide of the /mw/ sequence is realized either as a secondary articulation of the preceding consonant, i.e., as [mʷ], or as a secondary articulation of a double articulated velar-labial nasal stop, i.e., as [ŋ͡mʷ], or as a component of a light diphthong, [mŭV].[39] Some examples are given in (9), where the distinction between the terms 'Derived' and 'Underived' refers to whether a noun is derived from some other grammatical category (including a noun in another class), and nouns lacking such a derivation.[40] Moreover, N/V/A stems here refer to these without affixation, although they are still regarded as lexical items; i.e., /mw/ sequences are not found at morpheme boundaries but morpheme-internally. Thus, regarding /mw/ sequences, N's in Cl. 1 and 3 are analyzable morphologically, while N/V/A stems are not. Furthermore, 'Passive forms' refer to passive forms without any other suffix being present, such as, for example, the relative morpheme /-po/ 'when'.

[39] Nurse and Hinnebusch (1993: 173)) reports that a phonetic realization of /mw/ as [ŋ͡mʷ] is found in Giryama, Duruma, and Chonyi, among other Sabaki languages.

[40] Some 'Derived' nouns in Cl. 1 and 3 and at least one example found in 'Underived' nouns in Cl. 3 take one of the prefix alternants, /mu-/, even if the stem begins with a vowel (see 3.2.2). Phonetic realization of the prefix /mu-/ is [mu], thus a word /mua^{N}d̪iʃi/ (N. 1) ← /a^{N}d̪ika/ 'writer' ← 'write' is pronounced as [muwa$^{n̪}$d̪iʃi], which could be considered as involving glide insertion. As can be seen in its phonetic realization, this does not contain a /mw/ sequence. Thus, this type of alternant is excluded from discussion.

(9)

a. N/V/A stems

/a[mʷ]a/ (V)	'suck the breast (said of a baby)'
/[mʷ]aya/ (V)[41]	'tip out'
/kʰau[mʷ]a/ (N. 9/10)	'calumba root used for medicine'
/zi[mʷ]i/ (N. 5)	'demon'
/[mŭe]we/ (N. 9/10)	'bird of prey, hawk'
/[mŭi]ku/ (N. 9/10)[42]	'left-over food'

b. 'Underived' N's in Cl. 1 and 3

/[ŋ͡mʷ]aᴺga/ (N. 1)	'werewolf'
/[ŋ͡mʷ]ari/ (N. 1)	'girl in puberty'[43]
/[ŋ͡mʷ]aka/ (N. 3)	'year'
/[ŋ͡mʷ]ani/ (N. 3)	'algae'
/[ŋ͡mʷ]aɲa/ (N. 3)	'gap'

c. 'Derived' N's in Cl. 1 and 3

/[mŭi]vi/ (N. 1) ← /iba/ (V)	'thief' ← 'steal'
/[mŭa]ko/ (N. 3) ← /waka/ (V)	'heat'[44] ← 'blaze'
/[mŭa]ᴺbao/ (N. 3) ← /aᴺbaa/ (V)	'coast-line' ← 'pass near to without actual contact'
/[mŭa]ᴺzo/ (N. 3) ← /aᴺza/ (V)	'beginning' ← 'begin'

d. Passive forms

/fu[mʷ]a/ (Ps) ← /fuma/	'be woven'
/ka[mʷ]a/ (Ps) ← /kama/	'be milked'

The distinction between the three different phonetic realizations is summarized in (10).

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41 This verb is *mwaga* in Standard Swahili and it is also classified as a noun (see Johnson 1939).

42 This word is not used on its own in KiMvita but in an expression /wali mwa mwiku/ 'cooked rice left over from the previous day', though the word on its own can be found in Standard Swahili.

43 This word used to be used for a boy who has not undergone circumcision too, and the word is spelled *mwali* in Standard Swahili (see Johnson 1939).

44 In Standard Swahili, according to Johnson's (1939) dictionary, this word, derived from *waka*, has the meaning of 'blaze, flame'.

(10) Phonetic realization of /mw/

a. [m^{w}] N/V/A stems, Passive forms
b. [ŋ͡m^{w}] 'Underived' N's in Cl. 1 and 3
c. [mŭV] N/V/A stems, 'Derived' N's in Cl. 1 and 3

The phonetic realizations (10a) and (10b) involve labialization-velarization and thus could be categorized as a 'secondary articulation' (SA) type, whereas (10c) can be categorized as a 'light diphthong' (LD) type. Two observations could be made from the examples: (i) N/V/A stems show both SA and LD type of pronunciations; (ii) 'Derived' and 'Underived' N's in Cl. 1 and 3 are differentiated by the phonetic realization of /mw/.

The fact that the stems of N/V/A exhibit two distinct pronunciations could be vital for considering that a /mw/ sequence might not be analyzable as a possible phoneme. A question might be raised as to what is the cause of such a phonetic distinction in the same category of items. A closer look reveals that the distinction in terms of phonetic realization is related to the location of the /mw/ sequence: i.e., whether a /mw/ sequence is immediately preceded by a stressed vowel or not; the latter environment includes a word-initial /mw/ sequence which is followed by a stressed/non-stressed vowel. In (9a), except for the word /[m^{w}]aya/ (v) 'tip out', words exhibiting the phonetic realization of the LD type contain a /mw/ sequence which is not immediately preceded by a stressed vowel, while the pronunciation of the SA type is found in words containing a /mw/ sequence which is immediately preceded by a stressed vowel. This stress location factor is also true in Passive forms (9d) and 'Derived' N's (9c). In the passive forms, a /mw/ sequence is always immediately preceded by a stressed vowel and hence exhibits the pronunciation of the SA type. On the other hand, the /mw/ sequences in 'Derived' N's appear word-initially and are followed by at least a two-mora long stem, and therefore, phonetic realization will be the LD type. Moreover, a passive form with a suffix, such as a relative morpheme /-po/ 'when', should manifest the LD type of pronunciation if the stress location factor is a valid argument. In fact, my informant pronounces a word /fumwapo/ 'when (it) is woven' as /fu[mŭá]po/ (cf. /fú[m^{w}]a/). This fact further supports the stress location factor. However, the stress location factor is not valid for the case of 'Underived' N's (9b); even though they might be expected to exhibit the LD type of pronunciation, a pronunciation involving the secondary articulation, [ŋ͡m^{w}], is what is found. This is related to the second observation above. The fact that the pronunciation [ŋ͡m^{w}] is seen in 'Underived' nouns while that of [mŭV] is found in 'Derived' nouns seems to be a significant one; the KiMvita speakers differentiate their grammatical classification, and this is reflected in their pronunciation.

3. 3. 2. 4. 2 /kw/ sequences

Three different phonetic realizations are found for the /kw/ sequences, which occur in N/V/A stems, passive forms, and nouns (infinitive forms) of Cl. 15.[45] They are of both the SA type and the LD type, with or without aspiration. Except for the light diphthong type with aspiration, the other realizations are found also in the /mw/ sequences.[46]

Examples are shown in (11), where [k^{w}], [k^{h}ŭV] and [kŭV] represent the three types of pronunciation.

(11)

a. N/V/A stems

/[kŭe]li/ (N. 5)	'truth'
/[kŭa]si/ (A)	'rich'
/[kŭa]ʄuka/ (V)	'lose colour'

b. N stems (of Cl. 9/10)

/[k^{h}ŭa]re/ (N. 9/10)[47]	'partridge'
/[k^{h}ŭe]leo/ (N. 9/10)	'peg stuck in a tree'
/[k^{h}ŭa]to/ (N. 10)[48]	'cloven hoofs of an animal'
/so[k^{w}]e/ (N. 9/10)	'chimpanzee'

c. 'Derived' N's in Cl. 15

/[kŭe]^{N}deʃa/ (N. 15)	'to run a business/house'
/[kŭi]ʃa/ (N. 15)	'to finish'
/[kŭe]^{N}da/ (N. 15)	'to go'

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[45] N/V/A stems and Passive forms here also refer to /kw/ sequences which appear morpheme-internally and passive forms which are not affixed by any other inflectional affix respectively (see 3.3.2.4.1).

[46] Some derived nouns in Cl. 15 exhibit articulation involving a glide/glottal stop insertion; for example, words /ku-i^{N}ba/ 'to sing' and /ku-uza/ 'to sell' are phonetically realized as / [kuw]i^{N}ba/ and / [kuʔ]uza/ respectively. However, these types of pronunciation are of less concern here.

[47] In Standard Swahili, this is spelled as *kwale* (see Johnson 1939).

[48] This is the plural form of /ukwato/ (N. 11), which shows no aspiration. Most nouns in Cl. 11 take the Cl. 10 prefix for their plural forms, thus the stem-initial voiceless consonant /k/ is realized as /k^{h}/. This word contrasts with the word /kweli/ (N. 5) in (11a); /k^{h}w/ vs. /kw/.

d. Passive forms

/a^{N}d̪i[k^w]a/ (Ps) ← /a^{N}d̪ika/ 'be written'

/t̪a[k^w]a/ (Ps) ← /t̪aka/ 'be wanted'

Passive forms exhibit the SA type pronunciation, while the others all show the LD type with the exception of the word /so[k^w]e/ (N. 9/10) 'chimpanzee'. The examples in (11a, c) do not contain a /kw/ sequence which is immediately preceded by a stressed vowel, and hence it is impossible to create the conditions where a contrastive phonetic realization could be obtained. However, such a phonetic contrast can be seen in the examples in (11b). Moreover, as in the case of the passive forms with further suffixation of the relative morpheme /-po/ in the /mw/ sequences, the /kw/ sequences found in such forms exhibit the LD type of pronunciation as expected. Thus a word /a^{N}d̪ikwapo/ 'when (it) is written' is realized as /a^{N}d̪i[kŭá]po/ (cf. /a^{N}d̪í[k^w]a/). A final observation concerns the LD type with aspiration, [k^{h}ŭV], which is found in nouns of Cl. 9/10. Aspiration in such words should be regarded as a manifestation of the Cl. 9/10 prefix (see Nurse and Hinnebusch 1993).[49]

In summary, the /kw/ sequences appear to show the two distinct phonetic realizations, the SA type and the LD type, which arise by virtue of the location of the stressed vowel.

3. 3. 2. 4. 3 The possible C^w phonemes

To begin with, the lexical phonology of KiMvita is considered. In the course of discussion of the possible C^w (in general C^G) phonemes, we could postulate that there are at least two levels in the KiMvita lexicon based on the fact that allomorphs exist in the same class, such as pairs of prefixes for vowel-initial stems in Cl. 7 and 8; i.e., /tʃ-/ and /vy-/ vs. /ki-/ and /vi-/ (see 3.3.2.5.2).

Level 1 is regarded as a level at which underlying lexical items are introduced; Structure Preservation (see 2.3.2) requires that all the phonemes are found at this level. However, the classification in (12), where only items essential for discussion are exemplified, should be regarded as tentative. We shall need to revise that classification when some other aspects of KiMvita phonology have been considered (see 4.2.3.1).

[49] However, this is not always true; for example, nouns of Cl. 9/10 such as /ka^{N}ba/ 'rope' and /tʃai/ 'tea' do not manifest aspiration, although aspiration is found in a word /k^{h}a^{N}ba/ for 'crustacean'.

(12)

Level 1:	N/V/A stems 'Underived' N's of Cl. 1 and 3 Vowel-initial stems with prefixes /tʃ-/ and /vy-/ of Cl. 7 and 8 Passive/Causative forms
Level 2:	'Derived' N's of Cl. 1 and 3 'Derived' N's of Cl. 15 Vowel-initial stems with prefixes /ki-/ and /vi-/ of Cl. 7 and 8

In (12), the terms 'Derived', 'Underived', N/V/A stems, and passive/(causative) forms are specified as in 3.3.2.4.1.

Concerning items in Level 1, not all of them are unanalyzable, i.e., it contains not only underlying stems but also certain full formal lexical items; such items could be considered as unanalyzable lexical items at the surface structure despite the fact that they may contain discernible morphological boundaries. These boundaries are regarded as opaque. Hence, 'Underived' nouns of Cl. 1 and 3, passive forms, etc. are introduced in the level 1 phonology. Regarding the prefixes of Cl. 7 and 8 and causative forms, they will be discussed in 3.3.2.5.

The occurrences of the two types of pronunciation are summarized in (13), where N/V/A stems, 'Underived' nouns in Cl. 1 and 3, and passive forms are considered as underlying lexical items, as has been discussed in 3.3.2.4.1.

(13)

	SA type	LD type
/mw/:	N/V/A stems Pass. forms without a further suffix Cl. 1 and 3 'Underived' N's	N/V/A stems Pass. forms with a further suffix
e.g.:	/a[mʷ]a/ (V) 'suck the breast (said of a baby)' /fu[mʷ]/ (Ps) 'be woven' /[ŋ͡mʷ]aᴺga/ (N. 1) 'werewolf'	/[mŭe]we/ (N.9) 'hawk' /fu[mŭa]po/ (Ps) 'when (it) is woven'
/kw/:	N/V/A stems Pass. forms without a further suffix	N/V/A stems Pass. forms with a further suffix
e.g.:	/so[kʷ]e/ (N. 9/10) 'chimpanzee' /aᴺdi̤[kʷ]a/ (Ps) 'be written'	/[kŭa]si/ (A) 'rich' /aᴺdi̤[kŭa]po/ (Ps) 'when (it) is written'

In the previous subsections, we observed the two types of phonetic realization found in stems, that is, in underlying representations. Distinct pronunciations are also heard between passive forms with and those without a further suffix, as has been mentioned in 3.3.2.4.1 and 3.3.2.4.2 above. These facts indicate that the SA type pronunciation should not be considered as distinctive; rather that the occurrences of the SA type in pronunciation could be treated as locally determined phonetic facts. Thus, the two types of phonetic realization are determined according to whether or not a stressed vowel immediately precedes the Cw sequence; schematically:

- V̀CwV# : [Cʷ]	SA type	Stems, Passive forms without a further suffix
elsewhere : [Cŭ V]	LD type	Stems, Passive forms with a further suffix.

The Cw sequences found in various categories, except for 'Underived' nouns in Cl. 1 and 3, are best regarded as a sequence in which a w-glide generally becomes a component of a light diphthong, though preceding stress may modify this state of affairs.

To complete the discussion of Cw sequences, the final case, 'Underived' nouns in Cl. 1 and 3, needs to be dealt with. The prefix /mw-/ represents only one type of pronunciation, as a SA. However, we have just seen that there is no systematic correlation between underlying representations and the phonetic realization of the SA type. This line of argument could imply that the prefix /mw-/ of Cl. 1 and 3 also might not be phonemic. However, the Cw sequences of Cl. 1 and 3 'Underived' nouns, i.e., the prefix /mw-/, cannot be included in the discussion about the correlation between stress location and realization of a Cw sequence, since the prefix /mw-/ is never preceded by a stressed vowel. This case should be treated differently from other Cw sequences found within stems and passive forms. Secondly, as has been pointed out in 3.3.2.4.1, the significant point is that the double articulated velar-labial nasal stop with secondary articulation differentiates 'Underived' nouns from 'Derived' nouns of Cl. 1 and 3 formed at level two, as seen in (12). On account of these two considerations, the prefix /mw-/, phonetically realized as [$\widehat{\eta m}^w$], is to be treated as a distinct phoneme /$\widehat{\eta m}^w$/.

The treatment of /$\widehat{\eta m}^w$/ as a phoneme can be thought of in the following sense: the segments involved in the phoneme share the same articulators, i.e., labial and dorsal. This sharing of articulators is also found in occurrence of /mw/ other than those found in noun prefixes of Cl. 1 and 3; however, it is always regarded as a sequence. When the noun prefix /m-/ in Cl. 1 and 3 precedes a sequence of a high vocoid and a vowel (GV), the prefix becomes an onset to a GV sequence. This suggests that a GV sequence is analyzed as a light diphthong. Nevertheless, it might be considered that this /mw/ might be a possible candidate for a phoneme at some stage in the future, although the phonology provides evidence for regarding /mw/ as a sequence at the present time. In fact, the results of a phonetic experiment show that there is not a significant difference in the ratio of consonant to glide between the three specific environments that depend on the stressed vowel location (see Appendix C for details).

To conclude, all possible Cw sequences except for the prefix /mw-/ in 'Underived' Cl. 1 and 3 nouns are to be seen simply as sequences, in which a high round back vocoid forms a light diphthong with the following vowel. However when a Cw sequence is immediately preceded by a stressed vowel, its phonetic realization is as a secondary articulation. Finally, the phonetic manifestation of the prefix /mw-/ of Cl. 1 and 3 underived nouns is considered to be a distinct phoneme, /$\widehat{\text{ŋm}}^{w}$/.

3. 3. 2. 5 The Cy sequences

Consonant+high front vocoid (hereafter abbreviated to Cy) sequences are also frequent in KiMvita. The sources for Cy sequences are: (i) N/V/A stems, /fy/, /ny/, /my/, /py/, /vy/; (ii) Cl. 4 prefix, /my-/; (iii) Cl. 8 prefix, /vy-/; (iv) Cl. 9/10 prefix, /ny-/; (v) Causative forms, /-ny/, /-fy/, /-vy/.[50] Unlike the prefix in Cl. 9/10, those in Cl. 4 and 8 show variations when they precede vowel-initial stems; i.e., /mi-/ ~ /my-/ (Cl. 4) and /vi-/ ~ /vy-/ (Cl. 8).

The consonant components of Cy sequences in N/V/A stems are limited, namely to /f/, /m/, /n/, /p/, and /v/. Among these sequences, /ny/ is the most frequent one found in noun prefixes, in stems, and in causative forms. The sequence /ny/, in fact, does not exist underlyingly in KiMvita. It is always realized as a unit phoneme /ɲ/; though it appears as *ny* orthographically in Standard Swahili. However, /ny/ can be created at a morpheme boundary, for example in a causative form such as /fan-y-a/ 'do, cause to do'. Such a derived instance of /ny/ is also regarded as manifesting the phoneme /ɲ/. Therefore, any 'sequence' /ny/ will be excluded from the following discussion concerning possible C^{G} phonemes, although I shall occasionally need to make reference to it.

[50] The prefix of Cl. 9/10, and /ny/ in N/V/A stems and in causatives are not sequences as mentioned above. They are simply included here for completeness (see also fn 28). Moreover, the term 'N/V/A/stems refers to a Cy sequence which appears in an unanalyzable environment, i.e., morpheme-internally, as noted in 3.3.2.4.1.

Exclusion of /ny/ from the list of possible sequences enables us to make the following generalization in terms of articulators: the consonants /p, m, f, v/ share the same articulator, namely labial. On the other hand, the consonant /n/ employs the coronal articulator; this coronality is also found in the glide /y/. Thus, the shared coronality of its components would differentiate the consonant /n/ from the other consonants /p, m, f, v/ that are involved in Cy sequences. The absence of labiality from the complex segment /tʃ/, which is also regarded as a unit phoneme in KiMvita, should be noted.

In addition to the Cy sequences resulting from the affixation of the passive suffix /-w/, Cyw sequences such as /fyw/ and /vyw/ in words such as /bofywa/ ' be pressed of a soft surface such as fruit' and /t̪ovywa/ 'be dipped' also occur. Since they contain a Cy sequence, they are necessarily to be included in the discussion on possible Cy phonemes later.

In the next subsection, the prefix of Cl. 4 is discussed, which will be followed by discussion of the prefix of Cl. 8, of N/V/A stems and of causative forms. Then there will be a discussion as to the possible recognition of C^y phonemes.

3. 3. 2. 5. 1 The Cl. 4 prefix /my-/

The prefix occurring with a vowel-initial stem in Cl. 4, the plural form for nouns of Cl. 3, is either /mi-/ or /my-/. The following examples in (15) show nouns of Cl. 3 and 4, where [ŋ͡mʷ] and [mŭV] indicate a double articulated velar-labial nasal stop with secondary articulation and a high round back vocoid as a component of a light diphthong preceded by an /m/ respectively. In a parallel way to the second of these, [mĭV] indicates a high front vocoid as a component of a light diphthong preceded by an /m/. In addition to these, [m] indicates a special case where the high front vocoid component from within the Cl. 4 prefix seems either to have been deleted or to have merged with the initial vowel of a stem. Since glide-insertion processes affecting the prefixes /mu-/ and /mi-/, i.e., [muw] and [mij]/[mi], are of less interest in this study, nouns involving this further type of phonetic realization are excluded. Moreover, a very few noun stems beginning with the vowel /o/ are also excluded, since they show a rather unexpected pronunciation, which contains no obvious high front vocoid in the sequence.[51]

[51] They are: /[m]oyo/ (N. 3) - /[ɲ]oyo/ (N. 4) 'heart (in terms of ethics)', but */[mĭo]yo/, and /[m]oʃi/ (N. 3) - /[ɲ]oʃi/ (N. 4) 'smoke', but */[mi]oʃi/ or */[mĭo]ʃi/. Although /[ɲ]oyo/ is used in a conversation, /[ɲ]oʃi/ is found only in poems according to Sh. Yahya. These examples show that most of them seem to have abandoned a labial nasal - at least optionally.

(14) Nouns in Cl. 3 and 4

a. 'Underived' forms

	Cl. 3	Cl. 4	gloss.
/a/	/[ŋ͡mʷ]aka/	/[mĭa]ka/	'year'
	/[ŋ͡mʷ]aᴺba/	/[mĭa]ᴺba/	'rock in the sea'
	/[ŋ͡mʷ]aɲa/	/[mĭa]ɲa/	'gap'
	/[ŋ͡mʷ]avuli/	/[mĭa]vuli/	'umbrella'
/e/	/[ŋ͡mʷ]ezi/	/[m]ezi/	'moon, month'
/i/	/[ŋ͡mʷ]iba/	/[m]iba/	'thorn'
	/[ŋ͡mʷ]iko/	/[m]iko/	'spoon for cooking'

b. 'Derived' forms

	Cl. 3	Cl. 4	gloss.
/a/	/[mŭa]ᴺbao/ (← /aᴺbaa/)	/[mĭa]ᴺbao/	'coast-line' (← 'pass near to without actual contact')
/e/	/[mŭe]ᴺdo/ (← /eᴺda/)	/[mĭe]ᴺdo/	'a going' (← 'go')
/i/	/[mŭi]to/ (← /ita/)	/[m]ito/	'summon' (← 'call')

Pronunciation of the Cl. 4 prefix, then, is of two kinds: as [mĭ] and as [m]. In other words, a /my/ sequence found in nouns of Cl. 4 exhibits a pronunciation of the light diphthong type only, whether it is realized in an 'Underived' or in a 'Derived' form.

Concerning the pronunciation [m], there could be two ways to account for it. The first one is that the vowel /i/ of the prefix drops (see Polomé 1967). The second one is that the two high vocoid segments are merged by undergoing a process, which is equivalent to light diphthong formation (see chapter 4 for discussion). Schematically, /mi/+/ito/ → [mito] but *[mʲito], *[mĭito] or *[mi:to]; two identical vowels appear to become a single vowel instead of forming a light diphthong.[52] The second analysis is plausible, because some other vowel sequences created at the juncture of a prefix and a stem also exhibit such

[52] The same analysis could apply to the case of /mu/+/uᴺgu/ → /muᴺgu/ but *[mʷuᵑgu], *[mŭuᵑgu] or *[mu:ᵑgu] 'God' in some Swahili dialects including Standard Swahili; but in KiMvita, [m̩ᵑgo]. Forms such as *[mĭito], *[mi:to], *[mŭuᵑgo] and *[mu:ᵑgo] contain sequences of two identical high vocoids, which could be thought to be prohibited in virtue of the Obligatory Contour Principle (see Leben 1973), which forbids a sequence of two identical segments in many languages.

merger; for example, nouns in Cl. 2 such as /wa̲ + a̲limu/ → /wa̲limu/ 'teachers', /wa̲ + i̲vi/ → /we̲vi/ 'thieves', etc. In the case of the word /wevi/, it is clear that neither the vowel /a/ of the prefix /wa-/ nor the stem-initial vowel /ị/ drops, but that the two vowels coalesce.[53]

3. 3. 2. 5. 2 The Cl. 8 prefix /vy-/

The prefix allomorphs of Cl. 8, the plural counterparts of the Cl. 7 prefix allomorphs /ki-/ and /tʃ-/, are /vi-/ and /vy-/. The distribution of these is that the prefixes /ki-/ and /vi-/ generally appear before a consonant-initial stem while the prefixes /tʃ-/ and /vy-/ precede a vowel-initial stem. However, the prefixes /ki-/ and /vi-/ do also precede vowel-initial stems, as in (15c). Examples are given below.

(15) Nouns in Cl. 7 and 8

	singular	plural	gloss
a.	/ki-boko/	/vi-boko/	'hippopotamus'
	/ki-t̪abu/	/vi-t̪abu/	'book'
	/ki-su/	/vi-su/	'knife'
b.	/tʃ-a^{N}d̪a/	/vy-a^{N}d̪a/	'finger'[54]
	/tʃ-e^{N}be/	/vy-e^{N}be/	'arrow'
	/tʃ-oo/	/vy-oo/	'toilet'
	/tʃ-u^{N}ba/	/vy-u^{N}ba/	'room'
c.	/ki-atu/	/vi-atu/	'footwear'
	/ki-ini/	/vi-ini/	'egg yolk'[55]
	/ki-oo/	/vi-oo/	'mirror'
	/ki-uno/	/vi-uno/	'waist'

The occurrences of both the prefixes /ki-/ and /vi-/, and /tʃ-/ and /vy-/ for vowel-initial stems must raise the question as to how a delimitation is to be

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[53] Coalescence of the vowels /a/ and /i/ results in the vowel /e/. This can be explained by the internal organization of features, although I do not intend to demonstrate that here.

[54] This word is provided by my informant, Sh. Yahya, and also appears in Johnson (1939). The word /tʃa^{N}d̪a/ is used around the Mombasa area. In Standard Swahili *kidole (cha mkono)* is the word for 'a finger (of a hand)'.

[55] According to Sh. Yahya, this word does not express the meaning of 'kernel', which is the case in Standard Swahili (see Johnson 1939). In KiMvita, /ko^{N}de/ or /k^{h}oko/ is used for 'stone of fruit'. These two words with the same meanings are also found in Standard Swahili.

drawn; one group of nouns occurs with the prefixes /ki-/ and /vi-/, whereas another occurs with the prefixes /tʃ-/ and /vy-/. When historical facts are taken into consideration, we see that if a stem-initial consisted of a consonant historically, then the prefix /vi-/ was chosen, otherwise the prefix /vy-/ was chosen. However, some consonants that were once present have been lost (Bakari, 1985: 179), thus schematically; /ki - *Catu/, /vi - *Catu/ > /ki - ∅atu/, /vi - ∅atu/, but /tʃ - a^{N}d̪a/ and /vy - a^{N}d̪a/.

However, historical facts ought not to count in a synchronic analysis. We can find vowel-initial stems which take the prefixes /ki-/ and /vi-/ in a synchronic environment. Such a case is found when vowel-initial words including loanwords, such as of English origin, create diminutive forms; for example, /ki-e^{N}be/ 'small mango' ← /e^{N}be/ (N. 5) 'mango', /ki-arapleni/ 'small aeroplane' ← /arapleni/ (N. 9/10) 'aeroplane', etc. These words apparently seem not to be derived from an initial consonant loss historically. Thus, Bakari's analysis cannot be accepted in this thesis. A satisfactory account for this problem may be found within the ideas of Lexical Phonology (see 3.3.2.3).

Utilizing the insights of the concept of distinct 'strata' in Lexical Phonology, the selection of prefixes from /ki-/ and /vi-/ or /tʃ-/ and /vy-/ for the vowel-initial stems can best be analyzed as involving two sets of prefixes introduced at different morphological levels in the lexicon. In other words, both sets of prefixes are lexically determined, and hence, if the prefixes /tʃ-/ and /vy-/ are assigned to level 1, a stem such as /-a^{N}d̪a/ is chosen at this level, while a stem such as /-atu/ would be selected at level 2, where the prefixes /ki-/ and /vi-/ are available.

The question that must be raised next, however, concerns how vowel-initial stems preceded by the prefix /ki-/ are pronounced; for example, is a word such as /ki-atu/ pronounced as [kiatu], [k^{j}atu], [kĭatu] or [kijatu]? According to my informant, there are no possibilities of it being pronounced either as [k^{j}atu] or [kĭatu]; there is the possibility of an inserted glide, although sometimes this has a weak articulation. Thus a sequence involving /ki/ does not exhibit pronunciation of the secondary articulation type or of the light diphthong type, which is unlike the case of the Cl. 15 prefix /ku-/. This is sometimes realized as [kŭ] when it is followed by a vowel-initial stem, for example, /ku-iʃa/ → /[kŭi]ʃa/.

Regarding the possible recognition of Cy phonemes in the prefixes of Cl. 7 and 8, only the Cl. 8 prefix /vy-/ needs to be discussed, since the prefix /tʃ-/ of Cl. 7 has already been recognised as a unitary underlying phoneme /tʃ/. As has been discussed above, the distribution of all the prefixes in Cl. 7 and 8 is lexically determined, and, parallel to /tʃ/, the prefix /vy-/ could be treated as a phoneme. Assuming that /vy/ is regarded as a phoneme, say /vʸ/, a symmetrical balance would be seen, since the phoneme /tʃ/ would be assigned to its counterpart prefix of Cl. 7, /tʃ-/. However, the /vy/ sequence requires very careful analysis to finalize discussion about its possible phonemic status. After examining the stems in N/V/A and causative forms, a conclusion will be presented in section 3.3.2.5.4.

To sum up so far: in the discussion above concerning the Cl. 4 prefix and the Cl. 8 prefix, there does not seem to be enough evidence to hand to reach a definite conclusion as to whether or not they are phonemes. The consideration of the location of a stressed vowel, as was seen to be relevant in the discussion about the Cw sequences, ought also to be exploitable for the investigation of possible Cʸ phonemes. However, the sequences seen in these prefixes could not be considered in this way, since both of them appear word-initially and are followed by stems that are at least two morae long. Other Cy sequences found in the stems or causative forms also need to be examined.

3. 3. 2. 5. 3 Stems of N/V/A and Causative forms

All the possible Cy sequences listed above, i.e., /fy/, /my/, /py/ and /vy/, are found in the stems of N/V/A, and in causative forms of verbs. Examples are given in (16). Limited instances of Cy sequences are also found in passive forms, i.e., Cyw, which seems to be a special case, and will be dealt with later.

(16)

/fy/	/a[fʲ]a/ (N. 9/10)	'health'
	/[fĭa]ta/ (V)	'hold down'
	/[fĭa]ᴺd̪a/ (V)	'crush'
/my/	/ki[mʲ]a/ (N)	'silence'
/py/[56]	/[pĭa]/ (A)	'new'
/vy/	/a[vʲ]a/ (V)	'miscarry'[57]
	/t̪o[vʲ]a/ (V)	'dip'
	/le[vʲ]a/ (Cs) ← /lewa/	'make drunk'

[56] Another adjective *-pyoro* 'untrustworthy' is found in Johnson (1939), however, this is not found in KiMvita.

[57] According to my informant, in KiMvita, this word does not mean 'waste', as in Standard Swahili.

As has been discussed in 3.3.2.4.3, the pronunciation of the secondary articulation (SA) type found in a Cy sequence of an underlying lexical item is not necessarily to be regarded as a possible candidate for a phoneme. As can be seen in (16), two types of pronunciation, the SA type and the LD type, are found. A possible implication of the fact that distinct phonetic realizations are heard in such underlying lexical items is that a Cy sequence should not be seen as a unit phoneme.

However, before reaching such a conclusion, the location of the stressed vowel will need to be taken into account. The words in (16), along with some nouns of Cl. 4 and Cl. 8, will be examined. They are divided into two groups based on position of the stressed vowel; i.e., on whether a Cy sequence is immediately preceded by a stressed vowel or not. It might be predicted that a difference in pronunciation will be found depending on the environment of the stress as has been seen in the case of the Cw sequences in 3.3.2.4. Pronunciations obtained from my informant are, in fact, twofold: the SA type and the LD type. The former is found in a Cy sequence immediately preceded by a stressed vowel whereas the latter type is heard elsewhere.[58] The result obtained is displayed in (17).

(17) Phonetic realization of Cy in __ V́CyV# vs. elsewhere

	__ V́CyV# : SA type	elsewhere : LD type
/vy/	/á[v^{j}]a/ 'miscarry'	/[vĭá]^{N}d̪a/ 'fingers'
	/t̪ó[v^{j}]a/ 'dip'	/[vĭá]ma/ 'societies'
/my/	/kí[m^{j}]a/ 'silence'	/[mĭá]ka/ 'years'
		/[mĭá]^{N}ba/ 'rocks in the sea'
/py/	/ú[p^{j}]a/ 'newness'	-----
/fy/	/á[f^{j}]a/ 'health'	/[fĭá]^{N}d̪a/ 'crush'
		/[fĭá]ta/ 'hold down'

(17) shows that the contrast between pronunciation of the SA type and that of the LD type is completely related to the stress location factor. This result is exactly the same as the one obtained in the case of the Cw sequences.

Existence of the two types of pronunciation differentiated by a particular environment leads me to conclude that articulation of the SA type is merely a matter of phonetic realization, rather than evidence for an independent phoneme status. (See Appendix C for details of a phonetic experiment on the ratio of a consonant to a glide in the three specific environments). However,

[58] Concerning the pronunciation of /ny/ sequence, only the SA type is exhibited, regardless of the stress environment: this is, of course, just what we would expect.

before reaching a final conclusion on this matter, a rare sequence, Cyw, needs to be dealt with; a very special consideration might be required because of this rare sequence.

3.3.2.5.4 A Cyw sequence and the possibility of Cʸ phonemes

A Cyw sequence is mainly obtained as a result of affixation of the passive suffix. It is found in a limited number of cases; viz., /fyw/ and /vyw/. Examples are given in (18).

(18)

/fyw/	/bofywa/ (Ps) ← /bofya/ (Cs) ← /bopa/	'be pressed - of a soft surface such as fruit'
/vyw/	/t̪ovywa/ (Ps) ← /t̪ovya/	'be dipped'

The examples in (18) show that a sequence /fyw/ in a word of /bofywa/ occurs as a result of two derivations; i.e., a passive form via a causative form.[59] Although the passive form /t̪ovywa/ ← /t̪ovya/ does not result from two such processes,[60] these sequences could be treated as a special case for two reasons: (i) only a very few instances are found; (ii) it is not in all cases that a passive form may be derived from a causative form, and an original consonant may well be retained in a passive form; for example, /nawa/ 'wash' → /navya/ or /nawiʃa/ (Cs) → /nawiwa/ (Ps).

In an earlier discussion, Cw is already analyzed as a sequence, and in the lexicon, a w-glide, along with the following vowel, forms a light diphthong. Hence, Cy in a Cyw sequence could be better regarded as a unit phoneme. Otherwise, a Cyw sequence with the following vowel could create a three-[S] segment sequence, i.e., /fywa/ or /vywa/. Provided that /wa/ forms a light diphthong, such a sequence would produce an unattested pronunciation in KiMvita: either *[fiŭa]/*[viŭa] or *[fĭŭa]/*[vĭŭa]. However, when any observed contrast between two types of pronunciation based on the position of a Cy sequence with respect to stress placement is taken into consideration, analyzing a Cy sequence as a unit phoneme seems better to these limited cases. In other words, when the sequences /fy/ and /vy/ follow the passive suffix /-w/, they are

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[59] When consonants /p/ and /w/ precede the causative suffix /-y/, they undergo phonological processes and are realized as /f/ and /v/; i.e., /p/ +/y/ → /fy/, /w/ + /y/ → /vy/. Interestingly, the two sequences /fy/ and /vy/ are also the focus in the discussion about having possible phoneme status.

[60] Though it might be thought that /t̪ovya/ has been historically derived by causative formation.

regarded not as a basic underlying phoneme, but as what may be called a 'derived' phoneme. Nevertheless, this analysis would violate one of the key tenets of Lexical Phonology, namely Structure Preservation (see 2.3.2). Thus, both /fy/ and /vy/ sequences are best regarded as underlying unit phonemes. The phoneme /v^y/, then, contributes to a symmetrical balance in the Cl. 7 and 8 prefixes, as has been discussed in 3.3.2.5.2.

However, the segments under discussion do show distinct phonetic realizations depending on the location of the stressed vowel, and the analysis chosen considers this as contextual allophony. Moreover, the sequences of /fyw/ and /vyw/ are found in a very small number of occurrences. Therefore, the newly recognized phonemes, /f^y/ and /v^y/, should be understood as having a special status.

To conclude the discussion, all the possible Cy sequences, except for the newly established phonemes, /f^y/ and /v^y/, are not phonemes but sequences.

3. 3. 3 The Revised Inventory of Consonant Phonemes in KiMvita

Discussion about possible C^G phonemes has concluded that all C+G sequences, except for the newly recognized phonemes /ŋ͡m^w/, /f^y/, and /v^y/, are simply sequences.

Regarding the newly established prenasalized fricatives /^{N}v, ^{N}z/, they should be regarded as phonemes and added to the inventory of consonant phonemes proposed by Yahya Ali Omar and Frankl. However, such phonemes, along with the prenasalized stop phonemes, /^{N}b, ^{N}d̪, ^{N}d, ^{N}ʤ, ^{N}g/, are understood to be surface phonemes, and it therefore seems appropriate to reconsider the matter.

As we shall see in chapter 4, following discussion about the treatment of prenasalized consonants on the basis of Herbert's (1986) work and Hyman's (1985) 'Weight Theory', prenasalized obstruents in KiMvita are best regarded as a surface phenomenon. In other words, prenasalized obstruents are regarded as sequences at the input stage of the phonology; with regard to their function and at the phonetic level, they are seen as unit segments, regardless of their underlying or derived nature. Thus, prenasalized obstruents under the theory this thesis employs should be considered as containing two distinct phonemes. Consequently, the prenasalized stop phonemes which Yahya Ali Omar and Frankl proposed are withdrawn from the revised inventory of consonant phonemes. However /^{N}/ is considered as a distinct, though underspecified, component of a prenasalized obstruent. The archphoneme /^{N}/ always appears at the surface to contain a fully specified feature organization; for example, the word /ka^{N}ba/ 'rope' is realized as [ka^{m}ba]. Full discussion of the treatment of prenasalized obstruents and their syllabification will take place in chapter 4. Anticipating that discussion and the conclusion to be reached concerning prenasalized obstruents, I shall posit a revised inventory of consonant phonemes for KiMvita as in (19), where 'post-palatals' include the velar, uvular and laryngeal articulations.

(19) The Revised Inventory of Consonant Phonemes in KiMvita

		labials	dentals	alveolars	palatals	post-palatals
Stops:	voiceless	p	t̪	t	tʃ	k
	aspirated	p^{h}	t̪^{h}	t^{h}	tʃ^{h}	k^{h}
	voiced	b	d̪	d	ɟ	g
Fricatives:	voiceless	f	θ	s	ʃ	(χ)/h
	palatalized	f^{y}				
	voiced	v	ð	z		ɣ
	palatalized	v^{y}				
Nasals:	plain	m		n	ɲ	ŋ
	nasal component			N		
	velarized	ŋ͡m^{w}				
Approximants:	lateral			l		
	vibrant			r		
	glide	w			y	w

This consonant phoneme chart is constructed based on the facts reported in the literature and obtained from my own investigations in the light of the theories this study employs. As a result, three phonemes, /f^{y}/, /v^{y}/ and /ŋ͡m^{w}/, are added to the previous inventory, and the phonemic status of prenasalized stops is set aside, though a nasal component of prenasalized obstruents, /^{N}/, is given recognition. Moreover, as mentioned in the beginning of this chapter, the voiced implosive stops are removed, and consequently only one series of voiced stops /b, d̪, d, ɟ, g/ is set up.

The Arabic pronunciation of the 'emphatic' voiceless coronal obstruent,[t̴], (or [ṭ] may be employed among Arabic scholars) should be noted. It is pronounced, [t^{w}], with varying degrees of labialization and velarization among those KiMvita speakers who are familiar with Arabic. Therefore, strictly speaking, there is an additional phoneme /t^{w}/ for such people, though it is found in a limited set of loanwords; e.g., /t^{w}aibu/ (V) 'be well', /t^{w}ii/ (V) 'obey', etc.

However, an alternative pronunciation [t̪] is heard as the more ordinary one, and thus /tʷ/ is not listed in (19).[61]

Some relevant remarks are as follows, where prenasalized stops should be understood as surface phonetic elements only.

(a) The voiced stops are phonetically realized as implosive, providing that they are not components of prenasalized stops, and that they are in an onset position. The post-vocalic stops (in a 'coda' position), found in words of foreign origin, are realized as (ex)plosive, and are treated as allophones of the voiced stops that occur in an onset position.[62] A voiced stop consonant as a component of prenasalized stop is realized as plosive. Thus, we have [ᵐb], though *[ᵐɓ] does not occur at all, while [ɓ] in an onset position and [b] in a 'coda' position do occur.

(b) In the literature, it is usually said that the voiced palatal stop /ɟ/ does not occur as a component of a prenasalized stop but that the prenasalized dental stop occurs instead (see Bakari 1985, Nurse and Hinnebusch 1993). In fact, KiMvita manifests both a prenasalized voiced affricate and a prenasalized voiced dental stop: for example, /[ⁿ̪d͡ʒ]ema/ 'good' or /ka[ⁿ̪d͡ʒ]u/ 'cashew nut' and [ⁿd̪aː], instead of [ⁿ̪d͡ʒaː] 'hunger' in Standard Swahili. According to my informant, there is no clear distinction in terms of distribution between [ⁿ̪d͡ʒ] and [ⁿd̪]; it may be surmised that the former pronunciation may be borrowed from some other dialects or Standard Swahili. The pronunciation as [ⁿ̪d͡ʒ] is apparently a characteristic of Southern Swahili dialects including Standard Swahili, and the KiMvita-speaking area is located at the border of the Northern and the Southern dialects. It is therefore natural to expect that some pronunciations found in such dialects could have affected KiMvita.[63] Moreover, it is only when /ɟ/ is a component of a prenasalized voiced stop that it is realized as the affricate [d͡ʒ], i.e., [ⁿ̪d͡ʒ]; when /ɟ/ is preceded by a moraic nasal, it is realized as a voiced implosive stop [ʄ]; thus /mɟiᴺga/ (N. 1) 'ignoramus' is pronounced as [m̩ʄiᵑga] and not as *[m̩d͡ʒiᵑga].

(c) The voiceless affricate, /tʃ/, it is not found as a component of a prenasalized voiceless stop, *[ⁿt͡ʃ]. Generally, however, the KiMvita

[61] See also Tucker (1943-46: 866).

[62] As noted in 2.1.1.2 (fn 3), the term '(ex)plosive' is used here only in contrast with the term 'implosive'. Hence 'plosive' is used hereafter.

[63] See Whitely (1955) and Nurse and Hinnebusch (1993).

cognates of words containing this sound in other dialects are realized as voiceless aspirated dental stops, [t̪ʰ]. Hence, a word like *chui* [t͡ʃʰui] (N. 9/10) 'leopard' of the Southern Dialects, such as KiPemba and KiUnguja (see Nurse and Hinnebusch 1993), is pronounced as [t̪ʰui] in KiMvita. However, a voiceless aspirated dental stop is not always found where we might expect it; indeed an aspirated affricate is found in a word such as /tʃʰuᴺvi/ (N. 9/10) 'salt'. Such a pronunciation is thought to be borrowed from other dialects, as in the case of [ɲ̊d͡ʒ]. However, when a moraic nasal precedes the voiceless affricate, [t͡ʃ], it is always realized, thus the word /mtʃuᴺgwa/ (N. 3) 'orange tree' is pronounced as [m̩t͡ʃuᵑgʷa].

(d) The double articulated velar-labial nasal with secondary articulation /ŋ͡mʷ/, and the two palatalized fricatives, /fʸ/ and /vʸ/, are considered as phonemes in the current inventory according to the discussion in sections 3.3.2.4.3 and 3.3.2.5.4.

(e) The voiceless aspirated stops are found in two different contexts: (i) they occur root-internally, where they arose as a historical development of internal nasal+voiceless stop clusters, for example, */Nk/ > /kʰ/ in */nuNka/ > /nukʰa/ 'stink' (Meinhof 1932: 50); (ii) they occur initially in nouns of Cl. 9/10, where realization of the class prefix /N-/ is as aspiration of an initial voiceless stop; e.g., /pʰaka/ 'cat' - cf. /kipaka/ (N. 7) 'small cat'.[64]

(f) The fricatives /θ, ð, χ, ɣ/ are found almost only in Arabic loanwords, and appear in the speech of people who are familiar with Arabic. Speakers who are less influenced by Arabic substitute [s]/[t] for [θ], [z] for [ð], and [g] for [ɣ]. A uvular allophone [χ] of /h/ occurs in Arabic loans; however, this seems always to be in free variation with [h] except in a few lexical items (see Whitely 1955:19-20).

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64 According to my informant, usually only one aspiration is found in a word and the feature is taken by the first voiceless stop. However, in duplicated words, such as /ɲapʰaɲapʰa/ 'stalk, creep', and / kimkʰumkʰu/ 'madness' (cf. / kimkumku/ 'a lie'), two aspirations are seen. These examples were provided by Sh. Yahya (see also Frankl in consultation with Yahya Ali Omar 1991).

3. 4 The Inventory of Syllables

In a previous study on (Standard) Swahili (see Park 1995, 1997), it is claimed that only light (monomoraic) syllables exist in the syllable inventory.[65] Park (op. cit.) discusses this matter in relation to the 'minimal word effects' in (Standard) Swahili, which refers to the minimal size of a well-formed word, which is bisyllabic in Park's terms. His arguments attempt to demonstrate that a CVV sequence always consists of two distinct syllables rather than constituting a bimoraic syllable. He supports this claim by several pieces of evidence.[66]

Contrary to Park, I propose that KiMvita, indeed KiSwahili in general, requires both monomoraic (light) and bimoraic (heavy) syllables. The evidence provided by Park is not strong enough to convince us that the Swahili syllable inventory contains only monomoraic syllables, although it is true that KiSwahili seems to prefer monomoraic syllables. Using two arguments and an observation concerning vowel sequences in KiMvita, I shall attempt to refute Park's claim.

The first argument comes from a consideration of length alternations in stressed vowels. Swahili is a stress language, and one characteristic manifestation of stress is a stressed vowel undergoing lengthening. According to Park (op. cit.) the stress is borne by the penultimate syllable, and the actual stress bearer is either a vowel or a moraic nasal, but never a moraic obstruent. Park states that while in a word such as *amka* 'wake', no vowel length alternation is found in the leftmost syllable, a stressed vowel *a* in a word such as *kamba* 'rope' does show length alternation. Examples are given in (20), where a lengthened stressed vowel is represented by two vowel letters, and a syllable division is inserted on the assumption that the stress is, in fact, borne by a syllable. (However, what really is the stress bearer in KiMvita will be discussed in 3.5 below.)

[65] Polomé (1967: 50) lists the Swahili syllable types as follows: V, N, CV, CCV, C(C)VC, CCCV. Although he regards a C(C)VC as a syllable type, it is not clear whether this syllable type is counted as bimoraic or monomoraic (see also op. cit. : 49).

[66] See Park (1997: 97-146) for discussion.

(20)

	orthographic form	phonetic transcription	syllabification according to Park	my revised syllabification
a.	amka	[aṃ́ka]	a.m.ka	am.ka
	'wake'	[áṃka]	a.m.ka	am.ka
		*[a:ṃ́ka]	*a.a.m.ka	—
		*[á:ṃka]	*a.a.m.ka	—
	tamka	[taṃ́ka]	ta.m.ka	tam.ka
	'pronounce'	[táṃka]	ta.m.ka	tam.ka
		*[ta:ṃ́ka]	*ta.a.m.ka	—
		*[tá:ṃka]	*ta.a.m.ka	—
b.	kamba	[kámba]	ka.mba	—
	'rope'	[ká:mba]	ka.a.mba	kaa.mba
		*[kaḿba]	*ka.m.ba	—
	anza	[ánza]	a.nza	—
	'begin'	[á:nza]	a.a.nza	aa.nza
		*[ańza]	*a.n.za	—

(. indicates a syllable boundary)

In (20a), in *amka* and *tamka,* stress falls either on the first vowel *a* or on the moraic nasal *m,* while in (20b) in *kamba* and *anza,* the only possible stress bearer is the first vowel *a,* since the nasals here are not moraic. Regarding lengthening of a stressed vowel, on the one hand, when a moraic nasal follows a stressed vowel as in (20a), no vowel lengthening occurs, while on the other hand, a stressed vowel, as in (20b), does get lengthened when it is followed by a prenasalized obstruent, *mb* or *nz* in this case.

Park's (1997: 113) point concerning these examples is that the stressed vowels in (20b) are in the penultimate syllable while those in (20a) are not in the penultimate syllable as illustrated in (21b) and (21a) respectively.

(21)

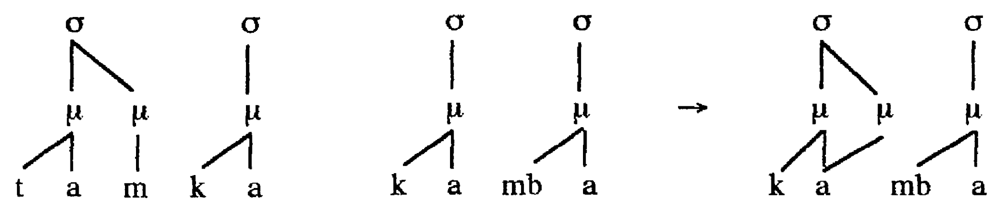
a. b.

Park does not give a principled explanation as to why only the penultimate syllable gets lengthened. Also Park's veto on bimoraic syllables ought surely require him to resyllabify the lengthened alternant as *ka.a.mba.* Moreover, regarding the stress alternation found in (20a), if the vowel were the stress bearer, he would have to say either that stress is not always on the penultimate syllable or that resyllabification takes place, so that the output would be *am.ka* or *tam.ka*. However, such resyllabification would require him to allow bimoraic syllables.

This stressed vowel lengthening can be explained in a principled manner if we allow a bimoraic syllable. As can be seen in the diagrams in (22), a stressed vowel followed by a moraic nasal is in a bimoraic syllable, as in (22a), whereas a stressed vowel is in a monomoraic syllable when followed by a prenasalized obstruent, as in (22b). Thus, it is clear that the vowel lengthening takes place only in the latter case, since the stressed vowel is in a monomoraic syllable, which implies that it is possible for it to lengthen, i.e., obtain one more mora. However, in the case of (22a), the stressed vowel is syllabified within a bimoraic syllable, hence it would be impossible to obtain another mora in order to lengthen it further, for this would create a trimoraic syllable.

(22)

a. tamka b. kamba



To include a bimoraic syllable in the Swahili syllable inventory can explain the stressed vowel lengthening phenomenon in an efficient fashion.[67]

The second argument for the existence of bimoraic syllables involves mostly words of Arabic origin containing moraic consonants such as /l, r, d̪, b, h, s, ʃ, f, k, n/, for example, /ma**k**t̪aba/ 'library', /ka**b**la/ 'before', /alhamisi/ 'Thursday', /bin̪t̪i/ 'daughter', etc.[68] These consonants in a 'coda' position retain moraicity, as do the moraic labial nasals and /N-/ with a monomoraic stem in words of Cl. 9/10. However, they may not bear stress like the moraic labial nasals just considered. A question must be raised as to how the moraic

67 The surface syllable structure of a stressed vowel in a monomoraic syllable appears to contain a long vowel. However, this long vowel is different from an underlying long vowel; it is a single segment which is associated with two morae. Regarding the representation of an underlying long vowel, as will be discussed in 4.2.2.3.2, two distinct segments are associated with two distinct morae, which are syllabified into a bimoraic syllable.

68 A labial nasal in a word such as /ad̪am/ 'personal name' is not listed as a post-vocalic moraic nasal because of its very rare occurrence.

obstruents are treated in a syllable. Park's (1997) discussion concerns post-vocalic consonants, which are regarded as syllabic in his terms on the basis of the counting syllables in poetry. Such consonants are regarded as moraic in this study for the MCR does not take place in KiSwahili. Thus, there might be three possibilities for such a consonant: (i) to remain unsyllabified; (ii) to constitute a distinct monomoraic syllable; (iii) to link to the second mora of a bimoraic syllable.

First of all, the possibility (ii) is rejected, since there is no obvious syllabic nucleus. Although the other two possibilities are both equally plausible at first glance, the possibility in (iii) is the most appropriate one. When the distribution of implosive and plosive stops is considered, such an issue is better accounted for in terms of the position of such stops in syllables, i.e., either as onsets or as 'codas', than in terms of unsyllabified or syllabified morae. If possibility (i) were adopted, unsyllabified voiced stops would be plosive. Moreover, employing unsyllabified morae should be regarded as the least-preferred solution.

The two proceeding arguments could be seen as sufficient to establish the claim that both monomoraic and bimoraic syllables exist in KiMvita. But in addition to those arguments, the need for bimoraic syllables in KiMvita is required by diphthong- like vowel sequences, such as /ai/ or /au/ in words such as /tʃai/ (N. 9/10) 'tea' or /ʃauri/ (N. 5) 'advice', and this gives strong supporting evidence for the earlier arguments.

All the possible vowel sequences which can be created from five vowels actually do occur, e.g., /barua/ 'letter', /kofia/ 'hat', /zoea/ 'be familiar with', /jioni/ 'evening', /tui/ 'extract of coconut', and so on. They are quite often broken up by the insertion of a glide, which results in two distinct syllables - although a bimoraic syllable can be found as well in such sequences. The insertion of a glide between members of a vowel sequence suggests that KiMvita prefers a monomoraic syllable to a bimoraic syllable whenever possible. But in contrast to this, the diphthong-like vowel sequences never get epenthesized by any glide. Since the MCR is not activated in KiMvita, such vowel sequences must constitute a bimoraic syllable. If the MCR were considered as having operated, the diphthong-like vowel sequences would share one mora; i.e., μ

a i. As a result, words such as /tʃai/ (N. 9/10) 'tea', /yai/ (N. 5) 'egg', etc., in which the stress is borne by the leftmost vowel, the vowel /a/ in these cases, would violate the penultimate stress bearer rule (as will be discussed in 3.5). But there is no violation if the sequence /ai/ is syllabified as a bimoraic syllable.

To conclude the discussion of the inventory of syllable types in KiMvita, we may say that bimoraic syllables as well as monomoraic syllables occur, however, a monomoraic syllable seems to be the preferred type.

3. 5 The Stress Assignment Rules

In the literature, it is claimed that in KiSwahili stress falls on the penultimate syllable (see Park 1997, among others). To the best of my knowledge, no one has so far claimed that the mora is the stress bearer. Since Yoshiba (1983) proposes that the mora on its own can account for stress or accent assignment phenomena in almost all languages, is it the case that KiMvita also employs the mora rather than the syllable to bear stress?

The five questions in (23) are discussed so that appropriate stress assignment rules for KiMvita may be proposed.

(23)

a. Is stress counted by morae or syllables?
b. What is the location of the stress?
c. Are all moraic segments counted for stress assignment?
d. Does stress shift occur ?
e. Can stress shift occur onto any type of moraic segment?

These questions will be answered taking into consideration the observations drawn from data provided by Sh. Yahya for KiMvita and by Park (1997) for Standard Swahili. In addition, the claims made in (24) and the assumption expressed in (25) are also vital for the discussion.

(24)

a. KiMvita phonology allows both monomoraic and bimoraic syllables.
b. In general, syllable nodes are required, since the distribution of implosive and plosive stops is explained by their positions in a syllable (see 3.3.3).

(25) Theoretical Assumption

Syllabification occurs before stress assignment takes place.

Note that in the following discussion, a 'moraic consonant' refers to an obstruent, a liquid or an alveolar nasal found in a 'coda' position in words of Arabic origin and also in a few of Sabaki origin, such as /l/ found in a word like /mfalme/ 'king', while a 'moraic nasal' refers to a labial nasal or any phonetic realization of the /N-/ prefix with monomoraic stems in Cl. 9/10. A 'moraic nasal' also refers to an alveolar nasal found in a word of Sabaki origin, such as /[ń̪]ne/ 'four'.

To begin with, the questions posed in (23c), (23d), and (23e) are dealt with on the basis of observations made from data provided by Sh. Yahya and Park (op. cit.) in (26).

(26)

a. Data from Sh. Yahya

/m;fá;l;me/ ~ /m;fa;ú;me/	'king'
/t̪a;ḿ;ka/	'pronounce'
/ma;í;t̪i/	'corpse'
/ji;ó;ni/	'evening'
/a;d̪á;mu/ ~ /á;d̪a;m/	'personal name'
/a;h;má;d̪i/ ~ /á;h;ma;d̪/	'personal name'
/ka;sí;mu/ ~ /ká;si;m/ (/ka;sí;m/)	'personal name'
/ma;r;má;ru/ ~ /má;r;ma;r/	'marble'
/ká;b;la/	'before'
/bí;n;t̪i/	'daughter'

(where ; indicates a mora boundary)

b. Data from Park

se.m.sé.m	'sesame'
m.fá.l.me	'king'
fú.r.sa	'incident'
tá.m.ka ~ ta.ḿ.ka	'pronounce'
a.mé.d	'personal name'
a.h.mé.d	'personal name'
lá.b.da	'probably'
rá.s.mi	'official'
ra.í.su	'president'

(where . indicates a syllable boundary)

The question (23d) is answered straightforwardly by observing words such as /kabla/, /binti/, etc. in (26a) and *labda, rasmi*, etc. in (26b); stress shift does occur in both KiMvita and Standard Swahili.

Answers to the questions posed in (23c) and (23e) are seen in the following observations of the two data sets above.

From the forms pronounced by Sh. Yahya, it appears that speakers of KiMvita try to avoid word-final moraic consonants, and either employ final vowel epenthesis, or keep the location of the stress found in the word in the source language (if the speaker is familiar with it), in this case Arabic. For example, words such as /kasim/, /ahmad̪/, /ad̪am/ and so on manifest two patterns of stress placement, and according to Sh. Yahya, pronouncing such words without a word-final vowel is very rare among KiMvita speakers; for example, almost all people pronounce the word /kasim/ either as [kasímu] or with [kásim] as an alternative if he/she knows Arabic; however, the pronunciation [kasím] is almost unattested. The same analysis is also applicable to the words /ahmad̪/ and /ad̪am/. It seems that even though word-final consonants are allowed in some loanwords from Arabic, they are not moraic and so are not involved in the computation for stress placement. This interpretation of the word-final consonants could imply that KiMvita employs the MCR for word-final position in certain loanwords from Arabic. Alternatively, it could be assumed that such segments are regarded as extrametric, if the KiMvita phonology does not allow any segment associated with a mora, which is preceded by a nucleus, to lose its moraicity.

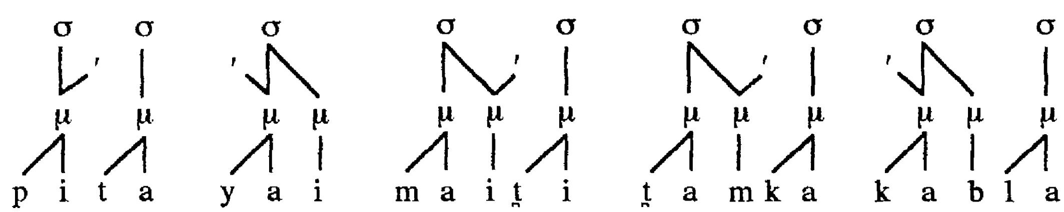
Regarding word-internal moraic segments, it is hypothesized that stress shift occurs when a post-vocalic consonant is associated with the penultimate mora. For example, words such as /bin̪ti/ 'daughter', and /kabla/ 'before' are realized as [bín̩.t̪i] and [káb̩.la] but not *[bíń̩.t̪i] and *[kab̩́.la]. On the other hand, no stress shift occurs when the penultimate mora is associated either with a vowel or with a nasal, which is found mostly in words of Sabaki origin. Thus, alternative stress patterns are not found in words such as /mai̪ti/ and /t̪amka/: [maí.t̪i] and [t̪áḿ̩.ka] but not *[mái.t̪i] and *[t̪ám̩.ka].

In the data cited from Park, word-final moraic consonants are clearly counted for stress assignment. With respect to word-internal moraic segments, the moraic nasals usually function as stress bearers, although stress sometimes occurs on the preceding vowel. However, the moraic consonants never bear stress, and it is hypothesized that stress obligatorily moves to the antepenultimate mora when such a segment appears as the penultimate mora.[69] In the case of the moraic nasals, such a shift is optional only; thus an alternating stress pattern is found as in, e.g., tá.m.ka ~ ta.ḿ.ka.

To sum up the observations, in KiMvita, word-final moraic consonants are found only in pronunciation influenced by Arabic, which is relatively rare, since vowel-epenthesis is considered to be preferable. Thus, provided that word-final consonants in KiMvita are regarded as non-moraic, or, alternatively, provided that they are treated as extrametric, it could be said that all moraic segments, regardless of their positions, are counted for stress assignment in the two languages. When the penultimate mora is associated with a consonant, that stress moves to its left is seen in both varieties. A nasal associated with the penultimate mora may also optionally show stress shift, though this is seen only in Standard Swahili.

The questions posed in (23a), which concerns the phonological entity which is counted for stress assignment, and (23b), which concerns the location of the stress are now considered. Five different types of word classified in terms of the segment which is associated with the penultimate 'mora' and its position in the syllable are examined; they are /pita/ 'pass', /yai/ 'egg', /mait̪i/ 'corpse', /t̪amka/ 'pronounce', and /kabla/ 'before'. Syllable structures for these words are given in (27). As mentioned above, in KiMvita, a word like /t̪amka/ shows only one type of stress pattern, which is [t̪aḿka], and so does a word like /maít̪i/.

(27)
a. /pita/ b. /yai/ c. /mait̪i/ d. /t̪amka/ e. /kabla/



The representations in (27) are divided into two types; in one the penultimate mora appears in a monomoraic syllable, as in (27a), and in the remainder, the penultimate mora appears to be the first or the second mora of a bimoraic syllable, as seen in (27b, c, d, e).

[69] Park does not provide examples containing a word-internal moraic alveolar nasal. However, according to Ahmad Kipacha, a native speaker of Standard Swahili, the words *binti* 'daughter' and *asante* 'thanks' are pronounced in the same way as in KiMvita, thus, [bíṇti] and [asáṇte] respectively, but not *[biṇ́ti] and *[asaṇ́te]; though the word for 'thanks' is [hasáṇṯa] in KiMvita.

With regard to the question (23a), in the examples (27), except for (27b) and (27e), the penultimate mora and the penultimate syllable are coterminous, it is therefore not clear which phonological entity is counted for stress assignment. However, the example in (27b) clearly shows that stress assignment is counted by morae and not by syllables, for no penultimate syllable is found in such a word. Therefore, the generalization should be made referring to morae; i.e., that the stress assignment is counted by morae. In (27e), stress shift occurs to /b/ of /kabla/ to the preceding vowel; because the segment associated with the penultimate mora is incapable of bearing stress, and thus it moves to the more sonorous segment to its left. Hence stress assignment is also counted by morae in this case.

An answer to question (23b) might be found in considering the occurrence of stress shift when the penultimate segment is associated with the second mora of a bimoraic syllable. Comparing (27c, d) with (27e), the fact that stress shift occurs only in (27e) while it does not in (27c, d) suggests that the syllable is not a reference point for the location of the stress. As we have discussed, stress shift occurs because of the features a particular segment contains, not because of its position, i.e., its being the second mora in a (bimoraic) syllable. Therefore, even if the stress is assigned to the second mora of a bimoraic syllable, such a mora does not need to construct an independent syllable in order to demonstrate that stress is located on a syllable. If that were the case, the stressed segment would be found in a monomoraic syllable, and stressed segment lengthening would take place. However, this does not happen. Unlike a word like /pita/, which is pronounced as [pí:ta], words like /yai/, /maiti/, /t̪amka/ and /labda/ do not in fact show noticeable stressed segment lengthening; they are phonetically realized as [yái], [maí̯t̪i], [t̪aḿ̩ka] and [káb̥la] - not as *[yá:i], *[maí̯:t̪i], *[t̪aḿ̩:ka] and *[ká:b̥la] (see Appendix B for phonetic evidence). Another argument which supports the current discussion is found in the case of monomoraic-stem items of Cl. 9/10. In words such as /N-bu/ [ḿ̩bu] 'mosquito' and /N-ge/ [ŋ̩́ge] 'scorpion', the moraic nasals appear to be the stress bearer. In word isolation, such nasals may not be syllabified since the Least Syllable Condition, discussed in 2.4.1, is not fulfilled. Hence it remains unsyllabified, which implies that the only possible stress bearer is the mora.

To conclude, stress assignment rules in KiMvita are presented in (28).

(28) Stress assignment rules in KiMvita

a. Stress placement is counted by morae

b. The penultimate mora in the word associated either with a vowel, with a labial nasal or with /N-/ (under certain conditions) is the stress bearer regardless of its position in a syllable.

c. Stress shift occurs when the penultimate mora is associated with a consonant, i.e., an obstruent, a liquid, or an alveolar nasal.

d. A word-final (moraic) consonant, if there is one, is non-moraic (or alternatively extrametric).

The rules in (28), except for (28d), are also applicable to Standard Swahili with an additional clause added to (28c), namely that a word-internal moraic labial nasal (and possibly /N-/) optionally induce stress shift.

Chapter 4
KiMvita - II

4. 0 Introduction

This chapter focuses on nasal plus consonant (N+C) sequences and on the syllabification of the two types of sequence, N+C and C+G(lide). In KiMvita realization of N+C sequences is twofold: (i) as a prenasalized consonant; (ii) as a moraic nasal and a consonant. These two types of nasal are differentiated by means of feature specifications, which will be discussed in section 4.1.1.2. Following this, the treatment of prenasalized consonants will be discussed based on Herbert's (1986) work, where a prenasalized consonant is treated as a sequence at a deep level, and realized as a unit at a surface/syllabic level. This line of treatment of prenasalized consonants fits very well with the framework being employed, including syllabification-related processes. As has been discussed, a sequence of C+G is realized in two ways; one involves a light diphthong and the other a complex segment involving secondary articulation. In section 4.1.2, the two types of composite segment, ^{N}C and C^{G}, are compared with regard to their underlying representations on the basis of proposals advocated variously by Sagey (1986), Clements (1987), Piggott (1988), Rosenthall (1988), and Clements and Hume (1996). Following this, syllabification of the two types of sequence will be investigated. Regarding the syllabification of N+C sequences, a device called 'feature linkage', which expresses sharing the same place feature, is a crucial way of distinguishing the two types of N+C sequence. The syllabification of C+G sequences requires two formations, namely, light diphthong formation and complex consonant formation.

4. 1 The Two Types of Sequence

In KiMvita, two types of sequence are found: (i) a nasal plus a consonant, N+C; (ii) a consonant plus a glide, C+G. Since the C+G sequences have been discussed in chapter 3, discussion of the N+C sequences is the prime focus of this section. Section 4.1.1.3 deals with treatment of the N+C sequences based on the thorough work done by Herbert (1986). In addition, the underlying representation of all types of composite segment is discussed within the theory of feature geometry. These are the prenasalized consonants, ^{N}C, the labialized-velarized/palatalized consonants, C^{w}/C^{y}, the affricates and double articulated segments such as the labial-velar nasal stop with secondary articulation, [ŋ͡m^{w}], found in KiMvita (see 3.3.2.4.1), the labial-velar stop, [k͡p], found in some West African languages, etc.

4.1.1 The N+C Sequences

As has been stated above, the N+C sequences in KiMvita are basically of two types: prenasalized consonants and sequences consisting of a moraic nasal and a consonant. These are symbolized in a general way as ^{N}C and ṆC respectively (where Ṇ indicates a moraic nasal in KiMvita).[1] Both types are further divided into two groups: derived and underived. In the following two subsections, the segmental classification of two types of N+C sequence, ^{N}C and ṆC, and the feature specifications of the nasal prefixes of Cl. 1 and 3, and Cl. 9/10 are examined. These sections are followed by the treatment of the prenasalized consonants; specifically, I discuss prenasalized obstruents.

4.1.1.1 The segmental classification of N+C sequences

The consonant component of a ṆC sequence may be virtually any consonant, while that of the ^{N}C is restricted; only a voiced stop or a voiced labial/alveolar fricative may occur. The consonants [θ, ð, ɣ, χ] are not found as a component of a ṆC sequence in a lexical word, though they appear in phrases, for example, [ṃðukuru] /m-ðukuru/ 'mention him!'. In the case of a high vocoid, /w/ or /y/, which is preceded by a nasal prefix /m-/, a nasal prefix becomes an onset, e.g., /m-wehu/ (N. 1) 'a crazy person' becomes [mŭehu]. In addition, a consonant may be followed by a glide in both types of N+C sequences, ^{N}CG or ṆCG, e.g., /[^{n}d]wee/ (N. 9/10) 'sickness' or /[ṃ]bwana/ 'man's personal name'.

The phonetically distinct realizations of N+C sequences in a word-initial position are determined by the noun class membership of the word in question. Thus, even a word which is composed of the same basic sequence

[1] In KiMvita, the term 'prenasalized consonant' refers only to 'prenasalized obstruent', and hence C in an abbreviation of ^{N}C is understood to be 'obstruent'.

orthographically (if KiMvita employs the Romanized orthography), for example *mb* and *mv* can be phonetically differentiated and, therefore, phonologically differentiated by the noun class membership. In other words, a N+C sequence of a word belonging to Cl. 1 and 3 is always realized as ṆC whereas ^{N}C is found in the realization of words in Cl. 9/10 - except for nouns with a monomoraic stem, in which case the ^{N} of the ^{N}C is realized as moraic as in (1b). Examples are listed below.

(1) N+voiced stops and fricatives in word-initial position

a.	/mbaʃiri/ (N. 1)	[ṃɓaʃiri]	'one who tells good news'
	/mbuni/ (N. 3)	[ṃɓuni]	'coffee bush'
	/md̪eni/ (N. 1)	[ṃɗ̪eni]	'debtor'
	/mdudu/ (N. 1)	[ṃɗuɗu]	'insect'
	/mdomo/ (N. 3)	[ṃɗomo]	'lip'
	/mgeni/ (N. 1)	[ṃɠeni]	'guest, stranger'
	/mgahawa/ (N. 3)	[ṃɠahawa]	'restaurant, café'
	/mɟi^{N}ga/ (N. 1)	[ṃʄi^{ŋ}ga]	'ignoramus'
	/mɟi/ (N. 3)	[ṃʄi]	'village, town'
	/mvuvi/ (N. 1)	[ṃvuvi]	'fisherman'
	/mvuke/ (N. 3)	[ṃvuke]	'steam'
b.	/N-buni/ (N. 9/10)	[^{m}buni]	'ostrich'
	/N-dege/ (N. 9/10)	[^{n}deɠe]	'bird'
	/N-d̪ia/ (N. 9/10)	[$^{n̪}$d̪ia]	'path'
	/N-goma/ (N. 9/10)	[^{ŋ}goma]	'drum'
	/N-vua/ (N. 9/10)	[^{ɱ}vua]	'rain'
	/N-vi/ (N. 9/10)	[ɱ̣vi]	'grey hair'
	/N-t̪i/ (N. 9/10)	[ṇ̪t̪^{h}i]	'country'

In the case of the N+C sequences in word-internal position, when a consonant of a N+C sequence is a voiced stop or a voiced labial/alveolar fricative, the sequence is realized as a prenasalized obstruent. However, it is realized as a moraic nasal followed by a consonant when any consonant other than a voiced stop or a voiced labial/alveolar fricative occurs, i.e., when a moraic nasal precedes a voiceless consonant, a nasal or a liquid. For example, a word such as /t̪amka/ (V) 'pronounce' contains a moraic nasal and a voiceless velar stop, whereas a prenasalized voiced velar stop is found in a word such as /ta^{N}ga/ (N. 5) 'sail'.

(2) N+C sequences in word-internal position

a. N̩C	/t̪amka/ (V)	[t̪am̩ka]	'pronounce'
	/namna/ (N. 9/10)	[nam̩na]	'type'
	/amri/ (N. 9/10)	[am̩ri]	'order'
b. ^{N}C	/ta^{N}ga/ (N. 5)	[ta^{ŋ}ga]	'sail'
	/tʃ^{h}u^{N}vi/ (N. 9/10)	[t͡ʃ^{h}u^{ɱ}vi]	'salt'
	/a^{N}za/ (V)	[a^{n}za]	'begin'

One prominent sound change that characterized the development of KiMvita was that a sequence of */N-/ + /ɟ/ or */N-/ + /tʃ/ in Cl. 9/10 came to be realized as a prenasalized dental stop, [$^{n̪}$d̪], or an aspirated dental stop, [t̪^{h}], respectively. However, in some words a sequence of */N-/ + /ɟ/ or */N-/ + /tʃ/ remained as a prenasalized post-alveolar affricate, [$^{n̠}$d͡ʒ], or as an aspirated affricate, [t͡ʃ^{h}], respectively. As mentioned in 3.3.3, for example, the adjective /ɟema/ 'good' is realised as /^{N}ɟema/ [$^{n̠}$d͡ʒema] when it is used with a noun of Cl. 9/10 or the word /tʃ^{h}u^{N}vi/ [t͡ʃ^{h}u^{ɱ}vi] 'salt' as in (2b). Our informant does not make any distinction between two phonetic realizations of /^{N}ɟ/ or /t̪^{h}/ in terms of distribution. Pronunciations of [$^{n̠}$d͡ʒ] and [t͡ʃ^{h}] in such words may be the influence of the Southern Swahili dialects, including Standard Swahili (see 3.3.3).

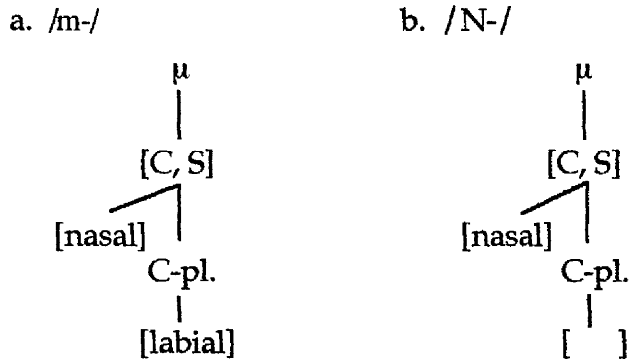
The next point to discuss is the feature organization of the various nasal prefixes, which can differentiate one from the other.

4. 1. 1. 2 The feature specification of the nasal prefixes

As we have seen, the nasal prefixes in Cl. 1 and 3 and Cl. 9/10 are realized as a moraic nasal and a nasal component of prenasalized consonants respectively. We should ask what it is that distinguishes these nasal prefixes in their feature representations.

I assume that at a very underlying level, the nasal prefixes are differentiated by their feature specifications; the nasal prefix /m-/ (Cl. 1 and 3) is fully specified on the place tier, whereas a nasal prefix /N-/ (Cl. 9/10) is not specified for a place node. These are depicted in (3).

(3)



In (3b), an unspecified place node will be filled by spreading of the place feature which the following consonant has, and consequently, the two segments come to constitute a homorganic prenasalized obstruent. (We will see in a later section that this corresponds to Stage 2 in the derivational model proposed by Herbert, and that a derivational process reliant on such a feature linkage will be described in 4.2.2.1.1.)

On the other hand, a fully specified nasal never undergoes such a derivation. As a result it stands alone and may precede virtually any consonant in KiMvita, since the nasal prefix /m-/ acquires no homorganicity with a following consonant. Therefore at a phonetic level, the voiced stops are always realized as implosive after the nasal prefix /m-/; in other words, an ingressive glottalic airstream mechanism is found in such a sequence (see 4.2.2.1.3).

To conclude this subsection, these feature organizations differentiate the nasal prefixes in Cl. 1 and 3 from Cl. 9/10. The basic stipulation of the feature specifications plays a crucial role when syllabification takes place, which will be discussed in 4.2.

A clear vision of prenasalized obstruents is also essential for syllabification-related processes. Discussion of prenasalized obstruents is undertaken in the following subsections.

4. 1. 1. 3 The treatment of prenasalized consonants[2]

There have been arguments in the literature as to the treatment of prenasalized

[2] In this section, the more general term 'consonant' is used rather than a more specific term such as 'obstruent' or 'stop'. However, as mentioned in fn 1 in this chapter, the term prenasalized 'consonants' refers in fact only to prenasalized 'obstruents' in KiMvita.

consonants, i.e., whether they are units or clusters.[3] We can find a thorough study of prenasalized consonants in Herbert's (1986) work, in which he advances a two-level model: a prenasalized consonant is a cluster at a deep level, but a unit at a surface/syllabic level.

In the following subsections, the treatment of prenasalized consonants as discussed by Herbert is sketched out, and then the treatment of prenasalized consonants in KiMvita within the moraic theory this thesis employs is discussed.

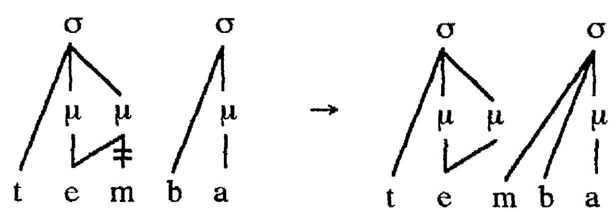
4.1.1.3.1 Herbert's work on prenasalized consonants

Herbert (1986) considers the topic of the treatment of prenasalized consonants from various perspectives; a phonological point of view and a phonetic point of view, and he states, "... prenasalized consonants are never underlying phenomena on a universal basis" (op. cit. : 122). Thus he rejects the unit analysis of prenasalized consonants at a deep level, and concludes that prenasalized consonants are to be regarded as clusters at a segmental level, but

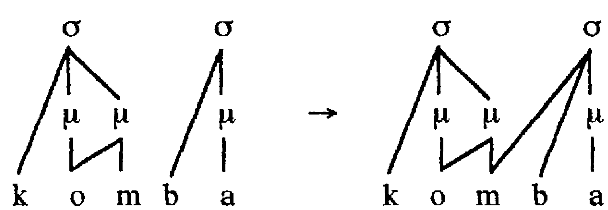
---

3 For example, in some other Bantu languages such as RuNyambo (Hubbard 1995), LuGanda (Herbert 1975, Frost 1995), IciBemba (Kula and Marten 1998) and so forth, the treatment of prenasalized consonants varies. Hubbard (op. cit.) shows that while the nasal element of the prenasalized stop is regarded as a member of an onset cluster after compensatory lengthening in LuGanda, in RuNyambo it is analyzed as a moraic nasal though sharing a mora with the preceding vowel as a result of vowel lengthening. Moreover, the nasal itself is associated with the following syllable node. These are diagrammed as in (1).

(1) a. Luganda /temba/



b. Runyambo /komba/



(Hubbard 1995:251)

On the other hand, Frost (1995) and Kula and Marten (1998), who work within the framework of Government Phonology, treat prenasalized stops as a cluster, hence they do not consider whether the pre-nasalized stops constitute a complex onset.

as units at a syllabic level. In his discussion, the use of the term 'cluster' should be interpreted as 'bi-phonemic cluster' or 'two-segment cluster'. Hence, the term 'cluster' is meant to denote 'two segment cluster' throughout the discussion.

Herbert's work is outlined in four subsections: (i) definition of prenasalization from the viewpoint of phonetics and phonology; (ii) phonological considerations; (iii) phonetic evidence; and (iv) his 'two-level model'.

4. 1. 1. 3. 1. 1 Phonetic/Phonological prenasalization

First of all, I shall cite the phonetic definition of prenasalization proposed by Herbert (1986: 10).

> A *prenasalized consonant* is formally defined as a necessarily homorganic sequence of nasal and non-nasal consonantal segments which together exhibit the approximate surface duration of 'simple' consonants in these language systems within which they function.

His phonetic definition of prenasalization contains three points: (i) nasal and non-nasal consonantal sequence; (ii) homorganicity; (iii) duration equivalent to a simple consonant. Among these three, (i) and (ii), but not (iii), are common among the languages of the world. Concerning (iii) the timing consideration is related to a discussion of phonetic evidence in 4.1.1.3.1.3 below.

With regard to phonological prenasalization, Herbert (op. cit.: 20) claims, "... a prerequisite for the recognition of phonological prenasalization is the independent existence of voiced oral stops (or fricatives) and nasal stops within a given language system". The term 'phonological' here should be understood to be 'surface phonological'.

4. 1. 1. 3. 1. 2 Phonological considerations

Several strategies have been put forward in order to account for a complex segment, whether it is a unit or a cluster. Among these, Herbert suggests that the following three considerations are most frequently cited with regard to prenasalized consonants: (i) timing considerations; (ii) sonority hierarchy considerations; (iii) syllable structure considerations. Here the timing and the syllable considerations are sketched out. These two considerations are related to a discussion of the phonetic evidence given in 4.1.1.3.1.3 below.

Concerning timing considerations, in many languages a prenasalized consonant exhibits approximately the same duration as a simple consonant.

Although claims are not usually based on instrumental measurement, observations are reported on languages such as Swahili (Welmers 1973), and LuGanda (Herbert 1975), among others. For example, Welmers's (1973: 68) impressionistic report of Swahili speakers claims that the timing of *mba, mbe* etc. is the same as *ta, te,* etc. For this reason, many authors claim that a prenasalized consonant should be regarded as a unit. However, Herbert (1986: 62) argues that timing organization is something that operates at a more surface level than that of the individual segment. This suggests that at a deeper level, prenasalized consonants may nonetheless be analyzed as clusters.

The next consideration is based on syllable structure. Many languages in which prenasalized consonants are found are said to be CV languages. Therefore, prenasalized consonants are traditionally treated as units by many scholars. Hagège's (1967) work on Wori is cited: prenasalized consonants in Wori, which is a CV language, have to be regarded as units, otherwise the generalization about syllable structure being CV could not be maintained. However, Herbert (op. cit.: 75) criticizes this kind of generalization; "The use of generalization in analysis is a classic problem in the philosophy of science". In the Bantu languages, which are classified as CV languages, some of them, in fact, do allow CVC syllables. Thus the generalization about CV languages is not totally valid for the Bantu languages. He states further that in a language such as Chiricahua Apache (Hoijer 1946: 59), a prenasalized consonant occurs either tautosyllabically or ambisyllabically depending on environments. Thus, surface syllabification does not provide any universal solution to the unit vs. cluster debate.

However, there are some processes which give evidence for the underlying cluster analysis. In KiVumba, which will be mentioned in 4.1.1.3.1.3 shortly, the nasal component of prenasalized consonants is realized as syllabic (moraic) when it is followed by a one-syllable (monomoraic) stem, otherwise it is realized as a unit with the following consonant at the surface level. The same phenomenon is also found in KiMvita, for example, /N-/ + /ge/ (N. 9/10) 'scorpion' is realized as [ŋ̩.ge] while /taᴺga/ (N. 5) 'sail' is realized as [ta.ᵑga].[4] According to Herbert this sort of alternation could not occur if prenasalized consonants were units at a segmental level. As Herbert (op. cit.: 69) states,

[4] Herbert (1986: 140) provides a very similar syllabic alternation found in Ndebele, in which the nasal prefix of Cl. 9 appears to be prenasalization of an initial oral consonant in a polysyllabic (polymoraic) stem while it appears to be syllabic (moraic) when a monosyllabic (monomoraic) stem follows it; e.g., *n͡dima* 'field' vs. *n̩:dwa* 'war'.

surface units can be derived from underlying clusters, whereas surface clusters do not obtain from underlying units.[5]

To sum up this subsection, Herbert's point is that the traditional analyses for prenasalized stops as units are still explainable, in fact, if prenasalized consonants are treated as clusters underlyingly. Herbert's analysis for prenasalized consonants is that they are always underlying clusters, thus a derivation is required in order for underlying clusters to become surface units.

4. 1. 1. 3. 1. 3 Phonetic evidence

Certain phonetic alternations which result from an interaction of prenasalized consonants with preceding vowels provide good pieces of evidence to support an analysis of prenasalized consonants as clusters underlyingly. Herbert provides four types of phonetic evidence; vowel quality, vowel nasality, vowel quantity and syllabicity alternations. Only two of these types of evidence, vowel quantity and syllabicity alternation, are examined; the other types of evidence are not particularly relevant for KiMvita.

The first type of phonetic evidence concerns the interaction of prenasalized consonants and vowel lengthening: vowels are lengthened when they precede prenasalized consonants. This phenomenon is reported in a large number of Bantu languages, such as LuGanda (Herbert 1975), CiYao and KiKerewe (Hubbard 1994), etc.[6]

Data from an instrumental experiment in LuGanda (Herbert 1975) shows that the duration of the nasal component of prenasalized consonants plus the duration of the lengthened vowel is equivalent to that of an underlying long vowel; schematically:

CVV = CV:N

ku	tuu		b	a
ku	tu:	n	d	a

(Herbert 1986: 136).

Since a lengthened vowel is normally shorter than an underlying long vowel, addition of the duration of the nasal component of the prenasalized consonant makes the overall duration equal to the duration of an underlying long vowel.

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5 In my analysis of KiMvita, such an underlying cluster is not a normal cluster, since two segments are tied by the Feature Linkage device (see 4.2.2.1.1).

6 Herbert (1986: 134) lists further languages such as Kikuyu (Armstrong 1940), Holoholo (Coupez 1955), Kuria (Whitely 1955), Luba-Kasayi (Meeussen 1960), Lwena (White 1949), Songye (Stappers 1964), Sukuma (Richardson 1959). See Herbert (op. cit.) for references.

In KiMvita, such durational equivalence can be found in the case where stressed vowel lengthening occurs in the first V of an underlying sequence such as CVNCV, which appears to be CV^{N}CV on the surface.

On the basis of this fact, Herbert (1986: 136) states that the nasal component of prenasalized consonants functions in the syllable to its left at the timing level.[7] This view supports the claim for the ambisyllabic nature of prenasalized consonants at a deep level. However, on a surface level, this nasal is adopted as a part of a unitary prenasalized consonant.

Another type of evidence for regarding prenasalized consonants as clusters stems from syllabic alternation, as was briefly outlined above. On a surface level, the nasal component of a N+C sequence sometimes exhibits alternations between tautosyllabicity and ambisyllabicity. This is seen in some Bantu languages. For example, in KiSwahili, when the nasal component of a prenasalized consonant bears stress, the N and the C of a N+C sequence appear in distinct syllables; otherwise they are tautosyllabic. Such alternations based on stress-bearing considerations occur in KiVumba, KiMvita, etc.[8] Herbert provides a couple of examples from KiVumba, which are shown in (4), where ̩ indicates syllabic.

(4)

ŋ̩́ɟe	'outside'	(2 syllables)
awáŋ͡ɟe	'get out'	(3 syllables)

(Herbert 1986: 140)
(ligature is mine)

Herbert (1986: 141) sums up the alternations as follows: "The traditional explanations for such alternations is to derive the independent units from the prenasalized consonants. However, ... the opposite approach is as tenable an analysis in its own right ...". This thesis, however, proposes a rather different approach to the analysis of these alternations (see 4.2.2.1.4).

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7 In Herbert's discussion, the term 'the timing' is used at two levels: the surface level and the deep level. Timing organization in the deep level, as discussed in the text, is that the duration of a nasal component of a prenasalized consonant, which contributes to the total duration of the preceding syllable, proves ambisyllabicity of prenasalized consonants, while timing adjustment at the surface level proves that the duration of a prenasalized consonant is to be regarded as that of a simple consonant.

8 This kind of alternation also occurs in other Bantu languages such as Ndebele, LuGanda, etc. In Ndebele (Ziervogel 1959 [in Herbert 1986]), the alternations take place between singular and plural forms. In LuGanda, the alternations take place, when a vowel pre-prefix is affixed to a morpheme beginning with a N+C sequence. See Herbert (1986: 140) for details.

On the basis of the discussion of prenasalized consonants briefly outlined above, Herbert proposes a two-level approach in analyzing the prenasalized consonants.

4. 1. 1. 3. 1. 4 A two-level approach

The point of Herbert's various arguments concerning the analysis of prenasalized consonants is that prenasalized consonants usually do not occur at a deep level of phonological organization (see Herbert's statement in the second paragraph in this subsection). In other words, prenasalized consonants are usually found as a nasal plus oral consonant cluster at a deep segmental level, though they may be realized as a unit at a surface/syllabic level.

In order for two underlying independent units to become a single complex phonetic unit, they must undergo unification processes, which involve homorganicity in articulation and/or timing adjustments. The term 'timing adjustments' in Herbert's use could imply that there would be distinct timing specifications for each segment underlyingly. For example, provided that each segment contains one mora or one length unit, after timing adjustment happens to the two segments, they share one mora (or one length unit such as a skeletal 'x'). This derivation is schematized as follows:

$$\begin{array}{cccc} \mu/x & \mu/x & & \mu/x \\ | & | & \rightarrow & | \\ /n/ & /d/ & & /nd/. \end{array}$$

Herbert (1986: 144) adds the following statement; "... we assume that the single crucial process which defines a state of unification is timing adjustment. That is, there can be no question of a unification of components unless the surface complex exhibits a duration which is approximately that accorded non-suspect underlying units ... . However, ... it does not necessarily follow from this claim and our claim about the non-occurrence of prenasalized consonants at the underlying level that all prenasalized consonants are products of component unification. Similarly, although ... some other complex units, e.g., some affricates, may be products of unification, we do not claim that all surface complexes result from such processes".

Regarding homorganicity, homorganic sequences can be seen without unification in many languages. Thus Herbert (op. cit.: 161) claims that homorganicity assimilation generally precedes unification and in addition to homorganicity, morphosyntactic information such as noun class membership may be crucial to unification in some languages. This happens commonly in Eastern Bantu languages, including KiMvita. A nasal prefix /N-/ of Cl. 9/10 'assimilates' (in terms of Herbert) to the following consonant,[9] while a nasal prefix /m-/ of Cl. 1 and 3 is realized as syllabic (moraic) regardless of the following consonant, hence, in the latter case, there can be seen accidental homorganic N+C sequences such as /mb/ and /mv/ without any sign of a unification process.

Herbert also considers some phonetic processes other than the two essential ones mentioned above. These are processes such as voicing assimilation, hardening of consonants, airstream mechanism assimilation and so forth, all of which take place at a segmental level.

To sum up Herbert's derivational approach, his model comprises two levels, the deep segmental level and the surface/syllabic level. The segmental level consists of two stages. Stage 1 is regarded as the phonological segmental level where prenasalized consonants are treated as distinct segments, a nasal and an oral consonant, and is a stage at which non-homorganic sequences may still occur. Stage 2 is regarded as the phonetic segmental level, where various phonetic adjustments such as positional assimilation, the nasal voicing assimilation, post-nasal hardening, etc. occur; however, not all of them necessarily take place. The timing adjustment occurs at the surface/syllabic level where a N+C sequence is unified and becomes a unit. Herbert exemplifies his model by examples from Delaware (Voegelin 1946), an Eastern Algonquian language. I shall cite his exemplification in (5), where ligature and syllable division are mine, based on Herbert's (1986: 145-146) discussion.

(5)

	a.	b.	c.
Stage 1	/šusanpi/	/hempsa/	/hempəs/
Stage 2			hembəs
Stage 3			he:mbəs
	[šu.san.pi]	[hemp.sa]	[he:.^{m}bəs]

(Herbert 1986:169)

According to Voegelin, in Delaware, all underlying stops are voiceless and three observations are made as follows: (i) these stops are voiced only when they follow a homorganic nasal and are followed by a vocalic element, as in (5c) /hempəs/; (ii) when a non-homorganic nasal precedes a stop, there is no voicing assimilation, as in (5a) /šusanpi/; (iii) the stop is not voiced after a homorganic

[9] Under the present theory, the process 'assimilation' does not occur; rather supply of the place feature to an underspecified nasal segment takes place by leftward spreading, as has been discussed in 4.1.1.2.

nasal if it is part of an extended cluster, as in (5b) /hempsa/ (Herbert op. cit.: 144-145). Words described in (i) such as /hempəs/ undergo voicing assimilation, and a vowel preceding a sequence of a nasal and a consonant gets lengthened. Herbert (op.cit.: 167) explains the derivation of three examples in the following terms. Words containing sequences other than underlying homorganic ones, /šusanpi/ and /hempsa/, remain at Stage 1, while underlying homorganic sequences such as /hempəs/, i.e., those produced at Stage 2 in some languages, undergo the voicing assimilation of Stage 2 and the timing adjustments of Stage 3 when they are not part of extended clusters.

Now I shall attempt to apply Herbert's derivational model for prenasalized consonants to KiMvita. The words /ta^{N}ga/ (N. 5) 'sail', /N-dege/ (N. 9/10) 'bird', /amka/ (v) 'wake' and /m-dudu/ (N. 1) 'insect' are exemplified in (6).

(6)

	'sail'	'bird'	'amka'	'insect'
Stage 1	/ta^{N}ga/	/N-dege/	/amka/	/m-dudu/
Stage 2	/ta[^{ŋ}g]a/	/[^{n}d]ege/		
Stage 3	/ta.[^{ŋ}g]a/	/[^{n}d]e.ge/	/am.ka/	/m.du.du/
	[ta.^{ŋ}ga]	[^{n}de.ɠe]	[am̩.ka]	[m̩.ɗu.ɗu]

In (6), a nasal and an oral consonant are regarded as distinct segments at Stage 1. On the one hand, as was discussed above, unlike the moraic nasal prefix /m-/ of Cl. 1 and 3, the place feature of the nasal prefix /N-/ of Cl. 9/10 is not specified, and therefore it needs to be filled in by spreading the place feature of the following consonant. This phonetic adjustment occurs at Stage 2. In the example /N-dege/, the place feature [alveolar][10] of the consonant /d/ spreads to the nasal prefix, and as a result, the partially specified nasal prefix is realized as an alveolar nasal. Finally, the two segments, /^{N}d/ are united as a result of the temporal adjustment at Stage 3, and consequently they are realized as a prenasalized consonant, [^{n}d]. A similar derivation is applied to the word /ta^{N}ga/. On the other hand, the word of Cl. 1 /m-dudu/ remains at Stage 1, since the nasal prefix /m-/ has a fully specified place feature and it remains moraic (syllabic); thus no unification processes occur. The nasal prefix /m-/ accidentally simulates homorganicity in some noun stems beginning with a labial consonant, but the two segments do not undergo unification. Hence they

[10] In Feature Geometry theory, a consonant /d/ is defined as [coronal]; however, since KiMvita distinguishes [dental] from [alveolar], the [alveolar] feature, which is considered to be a dependent of [coronal], is used in this study.

remain as a cluster; a moraic nasal and an oral consonant.[11] At Stage 3, the nasal prefix retains its moraicity, and the two occurrences of /d/ in the word /m-dudu/ are exclusively in an onset position and their phonetic realization is implosive, [ɗ]. In the case of word-internal N+C sequence, /m/ and /k/ of the word /t̪amka/ remains as a cluster, since the nasal is underlyingly specified for place, and hence /m/ remains moraic.

The analysis of prenasalized consonants proposed by Herbert really fits well with the moraic theory employed in this thesis. Correlation between his work and the present theoretical framework is looked at next.

4. 1. 1. 3. 2 The treatment of prenasalized consonants within the moraic theory

The idea of Herbert's two-level approach for prenasalized consonants, viz., that at a deeper level they are clusters, while in their surface realization they are units, is supported by the moraic theory that this thesis employs. The current theory explicitly exhibits such a derivational approach for prenasalized consonants (obstruents in KiMvita). It requires that every segment be associated with a distinct mora at the outset, and that at a later stage when syllabification takes place, certain N+C sequences will undergo unification; this process will be discussed in 4.2.2.1. Whatever type of rule is involved, it will derive a complex segment from two underlying separate segments. Thus, under the theory employed here, the prenasalized obstruents are not regarded as a single segment at the beginning of the phonology.

Another reason to reject the underlying unit (single segment) analysis comes from stress assignment considerations. In the case of monomoraic-stem items of Cl. 9/10, the only possible stress bearer is the nasal prefix, which usually becomes the nasal component of a prenasalized consonant when a stem contains more than one mora. For example, in a word such as /N-buni/ 'ostrich', the nasal prefix becomes a part of a prenasalized obstruent and the vowel /u/ bears stress, i.e., [^{m}búni], while in a word such as /N-bu/ 'mosquito', the prefix /N-/ needs itself to be the stress bearer; thus [ḿ̩bu]. If the nasal prefix of Cl. 9/10 is regarded as a part of a prenasalized unit phoneme, the prefix /N-/ followed by a monomoraic-stem item should require a rule which causes a nasal component of a prenasalized unit phoneme to become an independent

[11] Welmers (1973: 69) states that although the concord prefix *m-* of Swahili precedes all consonants, its syllabic (moraic) character is lost before labial consonants, *b* and *v*. However, this does not appear to be true, and in the standard language, as well as in KiMvita, the prefix /m-/ remains as moraic even when followed by these consonants.

segment, and to acquire its own mora. Such a procedure would surely not be straightforward.

The discussion above has focused especially on the derived prenasalized obstruents. However, it would not be consistent if the underived prenasalized obstruents - and there are many in KiMvita - were treated as a single segment underlyingly while the derived ones were treated as two. However, we will see later that underived prenasalized obstruents are differentiated from derived ones in terms of their featural organization. The treatment of an underlying prenasalized obstruent as a single segment at the outset is not preferred. Rejection of the single segment analysis requires some mechanism other than the Onset Creation Rule in order for a prenasalized obstruent as an underlying cluster to be syllabified as a unit, and this will be discussed in the section on syllabification below.

The last part of this lengthy section on the N+C sequences will present a brief summary concerning the moraic nasals.

4. 1. 1. 4 The moraic nasal and consonant sequences

The moraic nasals are twofold in KiMvita; /m/ and /N-/. The former may be either a stress bearer or a non-stress bearer, whereas the latter is always a stress bearer. A moraic nasal, [m̩], may precede virtually any consonant (see 4.1.1.1). A moraic nasal other than [m̩] occurs when a nasal component of a homorganic prenasalized obstruent becomes an stress bearer, hence a velar nasal [ŋ], for example, is realized as moraic and bears stress in a word such as /N-ge/ 'scorpion' (N. 9/10), i.e., [ŋ̩́ge].

Unlike prenasalized obstruents, a sequence of a moraic nasal and a consonant does not show homorganicity in terms of place of articulation except in accidental cases such as /mboga/ (N. 3) 'vegetable'. This is because the moraic labial nasal, [m̩], can precede most consonants, and one of these consonants may happen to have the same place of articulation. "Homorganicity" in KiMvita (and Standard Swahili) always involves a [voice] feature on a following obstruent, therefore a nasal followed by a voiceless obstruent does not constitute a homorganic prenasalized obstruent. In fact, the prefix of a word beginning with a voiceless consonant in Cl. 9/10 is truncated, though it is realized as aspiration on the stops, but not on the fricatives. In addition, 'plosiveness' (i.e., an egressive pulmonic airstream) is also an essential factor for homorganicity in KiMvita.

Regarding word-internal nasal and consonant sequences, as has been noted in 4.1.1.1, while a sequence of nasal and voiced obstruent is always realized as a prenasalized obstruent, when it is followed by any consonant except for a voiced obstruent a nasal is realized as moraic. Thus, /ta[ⁿg]a/ 'sail' and /t̪a[m̩k]a/ 'pronounce', viz., a prenasalized stop component and a moraic nasal respectively.

4. 1. 2 The Prenasalized Obstruents and the C+Glide Sequences

In this section, the C+G(lide) sequences are examined in comparison with the prenasalized obstruents. The C+G sequences appear to be twofold; G as a secondary articulation to a preceding consonant, represented as C^G, or G as a component of a light diphthong, represented as CG, where G should be understood to be a high vocoid as has been discussed (see 1.2.4.3.2 and 3.3.2.). The former may be compared with a prenasalized obstruent, in that both C^G and ^NC exhibit multiple articulation. We first look at Sagey's terms for composite segments exhibiting these two types of articulation.

4. 1. 2. 1 Sagey's terminology: contour segments and complex segments

Sagey (1986) distinguishes two kinds of composite segment, based on articulation order; these are either ordered or simultaneous, and hence she terms the former 'contour' segments and the latter 'complex' segments. For example, a prenasalized consonant, ^NC, is regarded as a contour segment because of its ordered articulation, from [nasal] to [oral] (i.e., from [+nasal] to [-nasal] under bivalent feature specifications). In contrast, complex segments such as the labial-velar stop, [k͡p], found in Yoruba, exhibit simultaneous articulation - classified usually as 'double articulations'. Affricates, like prenasalized obstruents, show the ordered articulation, from [stop] to [continuant] (i.e., from [-continuant] to [+continuant]), and thus are also regarded as contour segments.[12] A labialized and velarized or palatalized consonant, C^G, does not require such an order for its articulation, for all its components are pronounced simultaneously.[13]

Representation of contour and complex segments in the feature tree is looked at next.

[12] A different account for affricates is found in van de Weijer's analysis (1996).

[13] Thus, for example, Westermann and Ward (1933: 103) state that when the native speakers of the Suto-Chuana group of languages pronounce labialized and velarized consonants, it can be easily seen that the w-element goes through the whole of the consonant - the same is true in KiMvita.

4. 1. 2. 2 The representation of composite segments

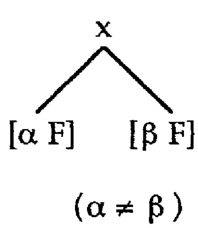
One of the main points here concerns how a feature tree relates to the number of root nodes and morae that a composite segment requires. In the following subsections, there is discussion of the contour segments, and subsequently of complex segments, where the representation of the newly established phoneme /ŋ͡mʷ/ is presented.

4. 1. 2. 2. 1 The representation of contour segments

The first point concerns the number of root nodes a contour segment requires. Two main analyses for representation of contour segments are seen in the literature. On the one hand, Sagey (1986) represents contour segments by means of a branching single segment as depicted in (7a), which is interpreted as a single branching root node by Clements and Hume (1996). This is shown in (7b), where a prenasalized consonant is exemplified, and an x is equivalent to a μ in this study.

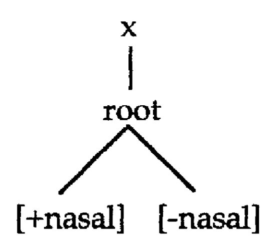
(7) One-root analysis

a.



(Sagey 1986: 255)

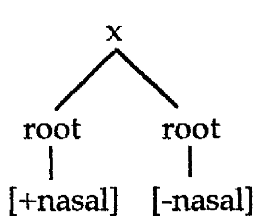
b.



(Clements and Hume 1996: 254)

On the other hand, Clements (1987), Piggott (1988), Rosenthall (1988), and Clements and Hume (1996) propose a two-root node structure for the contour segments as illustrated in (8).

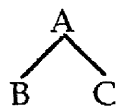
(8) Two-root analysis



(Clements and Hume 1996: 254)

Clements and Hume (1996: 254-256) state that the one-root analysis assumes that sequences occur with terminal features but not with the class nodes[14] and might produce theoretically possible but non-occurring complex segments, while the two-root analysis assumes a constraint that universally forbids branching structure under the root node. They state the No Branching Constraint as in (9).[15]

(9) The No Branching Constraint:
Configurations of the form



are ill-formed, where A is any class node (including the root node), A immediately dominates B and C, and B and C are on the same tier.
(Clements and Hume 1996: 255)

They continue that even with this constraint (as Rosenthall (1988) suggests), further principles are required to express the fact that not every sequence of root node constitutes a possible contour segment.

In comparing these two representations for contour segments, the framework employed here chooses the two-root analysis for two reasons. Firstly, there is a crucial theoretical problem in the one-root analysis: a one-root node cannot have two different sets of major class feature specifications, e.g., [C, S] and [C] for single segments. Next, as has been discussed in the treatment of prenasalized obstruents in 4.1.1.3.2, prenasalized obstruents are considered as clusters underlyingly, therefore two distinct root nodes for the nasal and oral segments are required.

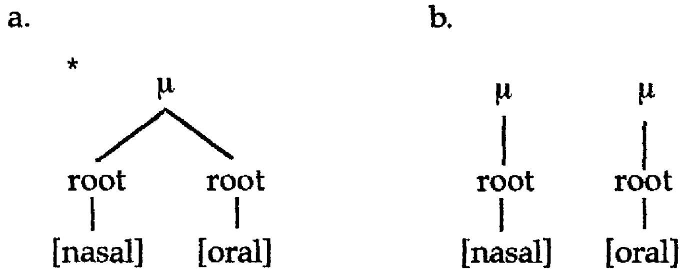
The next point concerns the number of morae with which a prenasalized obstruent having two distinct root nodes is associated. Compare the diagrams shown in (10), where (10a) is based on Clements and Hume's (1996) structure, while a revised structure is depicted in (10b).

---

[14] The class nodes are 'root', 'laryngeal', 'supralaryngeal', 'place', 'manner', and possibly 'tonal' (Clements 1985).

[15] A more specified version of constraint is found in Piggott's (1988) proposal.

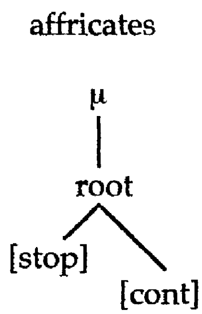
(10)



A structure having two root nodes linked to one mora, (10a), seems not to be an adequate representation especially for the prenasalized obstruents considered in this study. Following the treatment of the prenasalized obstruents as a cluster underlyingly, a structure containing two root nodes which are associated with distinct morae, as in (10b), is preferable. Moreover, Hyman's theory does not allow the representation in (10a), since only the right-hand root node can undergo the OCR (or any other relevant rule), and as a consequence, the leftmost root node is left behind (Hyman 1985: 120). In addition, as has been discussed in 4.1.1.3.2, the fact that the nasal component may be the stress bearer in monomoraic-stem items of Cl. 9/10 will support the revised representation; i.e., a structure containing two root nodes with distinct morae. When the Cl. 9/10 prefix /N-/ bears stress, a structure having two root nodes linked to one mora would require us to obtain a mora for the stress bearer; thus, its own root node associated with an independent mora for the prefix /N-/ is essential from the outset. Under the current theory, therefore, a structure of two root nodes with distinct morae as displayed in (10b) is posited for an underlying representation of the prenasalized obstruents. The structure (10b) represents a prenasalized obstruent underlyingly, and at a syllabic level, two morae will be reduced to one by certain rules.

In the case of affricates [t͡ʃ], no case could be argued for them to be a two-segment cluster underlyingly. However, as was mentioned just above, two root nodes with one mora is not a permissible structure under Hyman's theory, and so, such a structure is not applicable to affricates either. Hence, they are represented as a branching root node linked to one mora, as in the underlying representation given in (11). A branching root node seems to violate the Non Branching Constraint at first glance. However, the features [stop] and [continuant] (hereafter [cont]) are not on the same tier,[16] thus there would not be any violation of such a constraint.[17]

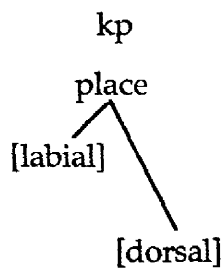
(11)



4. 1. 2. 2. 2 The representation of complex segments

With respect to the representation of complex segments involving a simultaneous articulation, following Clements and Hume's (1996) representation displayed in (12), a structure containing a branching place node is considered. This feature tree respects the branching constraint in (9) above, since the daughter features are on different tiers.

(12) Complex segment



(Clements and Hume 1996: 253)

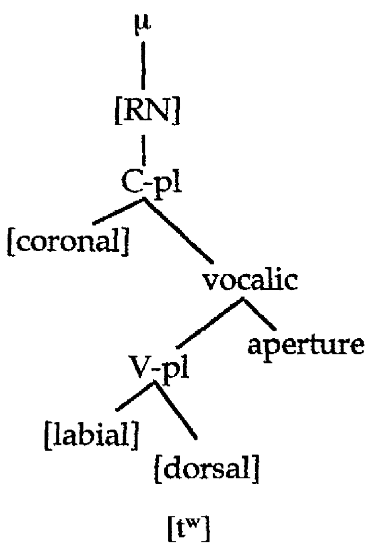
Concerning the underlying representation of consonants with secondary articulations, as we have discussed in 2.4.4.2, Clements's (1991a) proposal regarding incorporation of the V-place node under the C-place node is employed. In the feature tree, the V-place node is located under the C-place node via the vocalic node. A structure for an underlying $[t^w]$ is diagrammed in

[16] In fact, Clements and Hume's feature tree does not contain the [stop] feature, but only the [cont] feature with a +/- specification. Under the current theory, the monovalent features [stop] and [cont] are employed.

[17] Since this study does not deal with affricates in detail, I shall not discuss this further here. However, interesting discussions about internal organizations of affricates are to be found in the literature, e.g., van de Weijer (1996), among others.

(13), where the C-place shows a consonant [t] and a secondary articulation [^{w}] is exhibited by the V-place; the major articulator is always dependent on the higher node in the structure, in this case [t]. Regarding a place feature for [^{w}], in the literature [^{w}] is usually specified by the [labial] feature only. However, [w], is, in fact, defined as a double-articulated approximant, i.e., [labial] and [dorsal], in KiMvita.[18] Thus, in the diagrams employed throughout this thesis the two place features are represented for [^{w}]. The syllabification of a derived complex segment with a secondary articulation will be discussed later in this chapter.

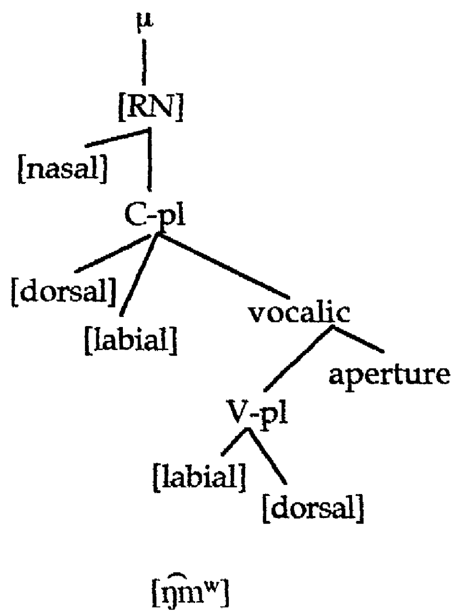
(13)



Representation of the newly established phoneme posited for KiMvita; /ŋ͡m^w/ is now discussed. Like affricates, this complex segment does not exhibit an underlying cluster, and furthermore, a combination of the double articulation together with the secondary articulation could opt only for a representation of one root node associated with one mora. A feature tree structure for the double articulated velar-labial nasal stop with secondary articulation could be depicted as in (14).

[18] See also fn 13.

(14)



4. 2 Syllabification

In the preceding sections, I discussed the treatment of the N+C sequences, ^{N}C and ṆC, and that of the C+G sequences, C^{G} and CG, within the moraic theory employed here. The syllabification of the prenasalized obstruents, the unstressed moraic nasals, the stressed moraic nasals, and the C+G sequences is discussed in this section. They are preceded by some general remarks on syllabification within the present approach, which is based on Hyman's (1985) theory.

4. 2. 1 Remarks on Syllabification and the Revised OCR

Construction of a syllable within the moraic theory employed here requires essentially both an onset and a nucleus, which is the Least Syllable Condition, as discussed in 2.4.1. When this requirement is met, a syllable is constructed as a result of the Onset Creation Rule (OCR).

This rule-based constructional approach, with its primitive templates, i.e., either a monomoraic syllable and/or a bimoraic syllable and/or a trimoraic syllable, carries the following implications. Firstly, if the requirement for the construction of a syllable is not fulfilled, then it is assumed that the OCR has not taken place, and no syllable is constituted. In other words, lack of either constituent means that a syllable may not be formed, and a string containing it remains at least partially unsyllabified. Secondly, unlike the templatic approach (see Itô 1986), as was discussed in 2.3.2, association with a mora enables a segment to be phonetically realized (see 2.3.3). 'Prosodic Licensing' in terms of Itô (op. cit.) is manifested by means of mora association in the current rule-based constructional syllabification approach. The last remark stems from the nature of the OCR, which is considered to be universal, and hence the rule takes place whenever the conditions are satisfied. This is an important conception of the OCR. Thus, under the current theory no rule could apply before the OCR occurs.

With respect to the Onset Creation Rule, I shall repeat Hyman's (1985) OCR from 2.4.2.1 here given as (15), where original [+cons] and [-cons] features are replaced with [C, (S)] and [S] respectively, and Hyman's x is replaced with μ.

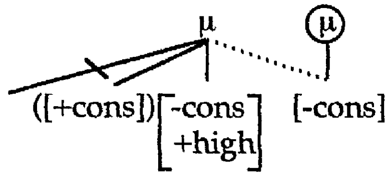
(15) Onset Creation Rule

a. b.

In KiMvita, sequences consisting of a w-/y-glide and a vowel, i.e., a sequence of [S]-[high][S] in terms of the major class features, are found abundantly, for example, /wewe/ 'you (sg.)', /waza/ 'think', /yai/ 'egg'. /yule/ 'that (person)', etc. In such a sequence, the glide clearly functions as an onset to the following vowel; viz., a sequence of [S]-[high][S] comes to constitutes a syllable. However, the OCR as depicted in (15) allows only a sequence of [C, (S)][S] to undergo the rule.

Hyman (1985) deals with sequences of [S]-[high][S] by employing a rule of Glide Formation (GF). Although the output of GF and the OCR is the same, i.e., two segments share one mora, the processes of the two rules are different. I shall repeat Hyman's GF, introduced in 2.4.3.2, as (16).

(16)



In Hyman's GF, the rightmost [S] loses its mora and relinks to the preceding mora which is associated with a (surface) glide. In other words, the nuclear segment/vowel loses its mora in GF, while in the OCR it retains its own mora. However, if a glide is to function as an onset, GF seems not to function in the same way as the OCR. The process of GF represents an unnecessarily powerful theory, since with a minor modification, the OCR can be reformulated to handle pre-vocalic high vocoids. Moreover, such a modification has not been undertaken only with KiMvita in view; it is something that would be required by most, if not all, of the world's languages.

In my view, the OCR needs to be revised so that sequences of [S]-[high]][S], may also undergo it. In such a sequence, the specification of the leftmost segment as [S]-[high] will exclude sequences such as /ai/ /au/ /ei/ /oi/ and so on, while the rightmost [S] could be regarded as any vowel. However, KiMvita needs an additional condition that the two [S]'s should not both share the same articulator and be of the same height; thus, */yi/ and */wu/ are not found.[19] A revised OCR in general is shown in (17), where [ ] indicates any segment which is moraic.[20]

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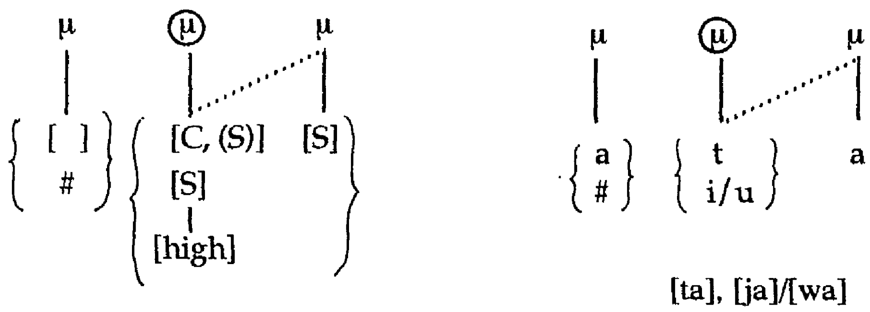
[19] Neither sequence actually occurs in KiMvita. It looks as if this is a language-specific condition - some languages would allow the revised OCR to apply to create *yi* or *wu*; for example, English /ji:ld/ *yield* or /wul/ *wool*.

[20] In (17), the [S] associated with a circled mora should be associated with the place feature, and the aperture node linked to the [±open] feature through the vocalic node, in accordance with Clements and Hume's (1996) model. However, such [S] is specified as a high vocoid by means of association of the [high] feature directly for two high vocoids for ease of exposition. Moreover, as mentioned in 2.4.2.1, the vertical linkage between the major class feature [S] and the [high] feature is expressed horizontally in the text, again for convenience.

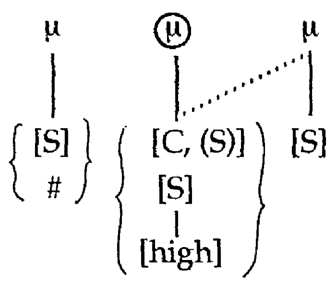
(17) Revised Onset Creation Rule (in general).

a. b.



The revised OCR (17) predicts that a sequence of [S]-[high][S] undergoes the OCR, when such a sequence is preceded by a moraic segment, specified by the language in question, or a word boundary. In KiMvita the leftmost mora may be associated with a [S] segment while in the case of Japanese, it is either a [S] or a [C, S]-[nasal] segment. A revised OCR for KiMvita is given in (18).

(18) Revised OCR for KiMvita.



Given this formulation of the revised OCR for KiMvita, the rule makes no allowance for a case where a consonant precedes the specified string, hence, a sequence of [S]-[high][S] found in a sequence [C, (S)][S]-[high][S] may not undergo the OCR.[21] Thus, the OCR may not apply to the sequence /ua/ of /barua/ (N. 9/10) 'letter' or a sequence /ia/ of /kiatu/ (N. 7) 'footwear'. This has an important implication for syllabification-related processes for a C+G+V sequence, which will be discussed later. The revised OCR is also relevant for words in Japanese which contain sequences *ya, yu, yo,* and *wa*; for example, *yayoi* 'March (lunar calendar)', *iNyu* 'metaphor', *wasabi* 'Japanese horseradish', etc.

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[21] In other languages, further conditions relating to the Margin Creation Rule (MCR) could be required. For example, in English we find words such as *onion* [ʌn.jən], etc., and in these words a glide is preceded by a consonant which undergoes the MCR (Dick Hayward, personal communication).

4. 2. 2 The Syllabification of N+C Sequences

A key factor which differentiates the syllabification of a moraic nasal from that of the nasal component of a prenasalized obstruent is whether or not a nasal retains moraicity. In a N̩C sequence, a nasal retains moraicity, no rule affects the nasal so as to lose its moraicity. The opposite of this is found in a ^{N}C, and as a consequence, two rules are required for the syllabification of prenasalized obstruents. In the following subsections, the process of syllabification is discussed under the assumptions discussed in 2.4.1: (i) the OCR is the first rule to apply; (ii) syllabification takes place strictly left to right.

4. 2. 2. 1 The syllabification of prenasalized obstruents

The prenasalized obstruents regarded underlyingly as two distinct segments require not only the Onset Creation Rule but also an additional rule. In the following subsections, the feature organization of prenasalized obstruents, the airstream mechanism for voiced stops, and an additional rule and a condition concerning minimal word size for monomoraic stems are discussed. In the discussion, two types of prenasalized obstruent should be taken into consideration: one is a derived prenasalized consonant found in a nasal prefix together with a consonant-initial stem of Cl. 9/10 nouns such as /N-buni/ [^{m}buni] 'ostrich'; the other is an underived one found in items of various grammatical categories, such as /ka^{N}ba/ [ka^{m}ba] (N. 9/10) 'rope', /e^{N}ba^{N}ba/ [e^{m}ba^{m}ba] (A) 'narrow, thin', /i^{N}ba/ [i^{m}ba] (V) 'sing', etc.

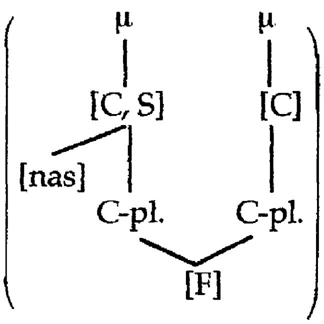
Before embarking on a discussion of an additional rule, the feature organization of prenasalized obstruents is examined.

4. 2. 2. 1. 1 Feature Linkage

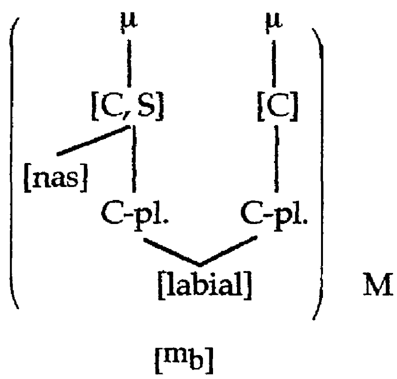
Recall that one crucial point which differentiates a nasal prefix of Cl. 9/10, /N-/, from that of Cl. 1 and 3, /m-/, is the place feature specification. The Cl. 9/10 prefix /N-/ has no place feature specification. Therefore, in the derived prenasalized obstruents created in these items, a nasal component has an empty place feature node, which subsequently undergoes a feature filling operation; it is filled by the spreading of the place feature from the following consonant. On the other hand, a nasal component of a prenasalized obstruent in underived cases always exhibits the same place feature as the following consonant underlyingly. Thus, both derived and underived prenasalized obstruents surface sharing the same place feature with the following consonant, hence their 'homorganicity'. Structures for the two types of prenasalized obstruent are diagrammed in (19) and (20): (19a) and (20a) are general structures which are exemplified in (19b) and (20b) respectively, where M indicates 'morpheme'. In these diagrams, the [C] root node should be understood to link to a [voice] feature (via the laryngeal node).

(19)

a. Underived ^{N}C

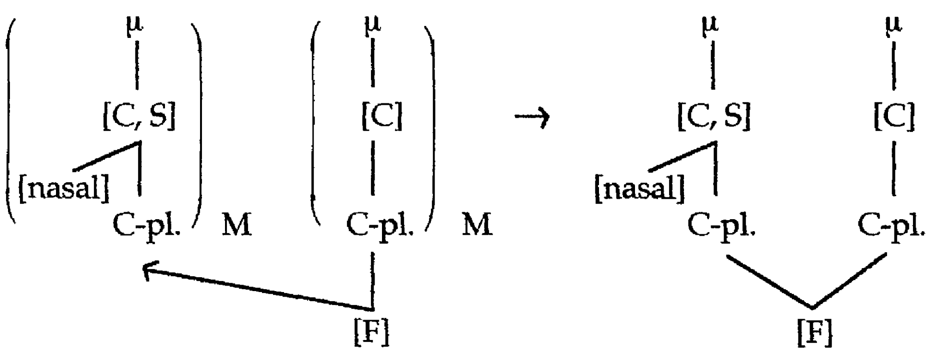


b. /ka^{N}ba/ 'rope'

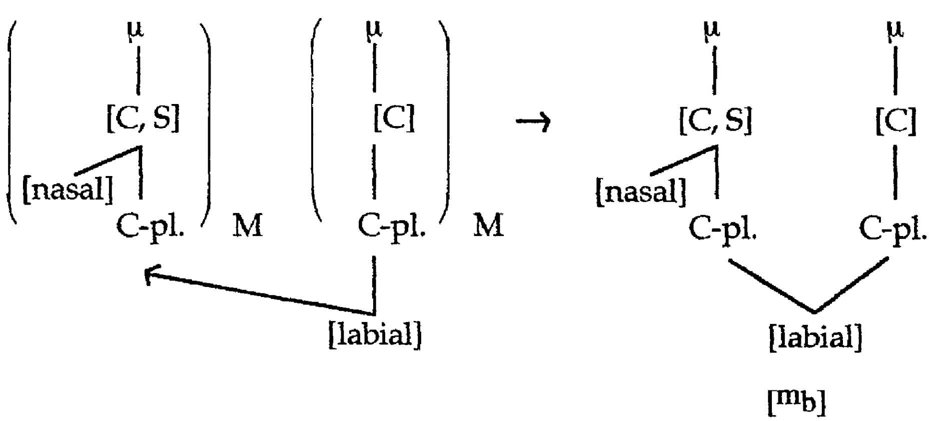


(20)

a. Derived ^{N}C



b. /N-buni/ 'ostrich'



As a result of the feature spreading in the derived environment, both underived and derived prenasalized obstruents share the same structure: the place feature is shared by two segments, which is exhibited by means of Feature Linkage.

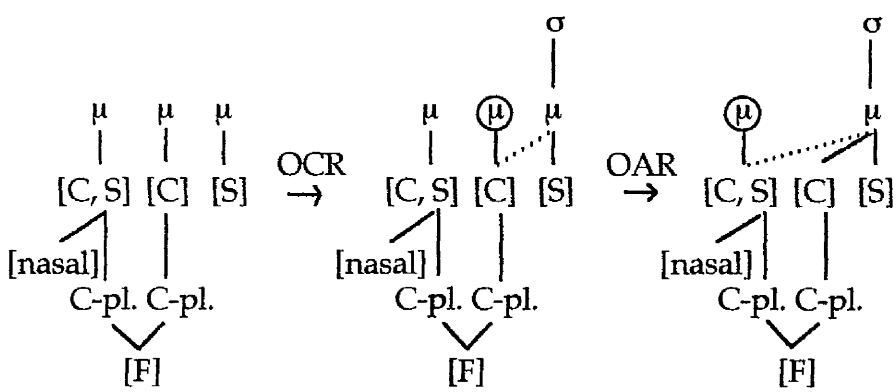
To sum up, the structures of both underived and derived prenasalized obstruents exhibit 'Feature Linkage', which is not found in a sequence of a moraic nasal and a consonant. Whenever this linkage has to be created, one more rule in addition to the OCR will be required.

4. 2. 2. 1. 2 An additional rule and conditions

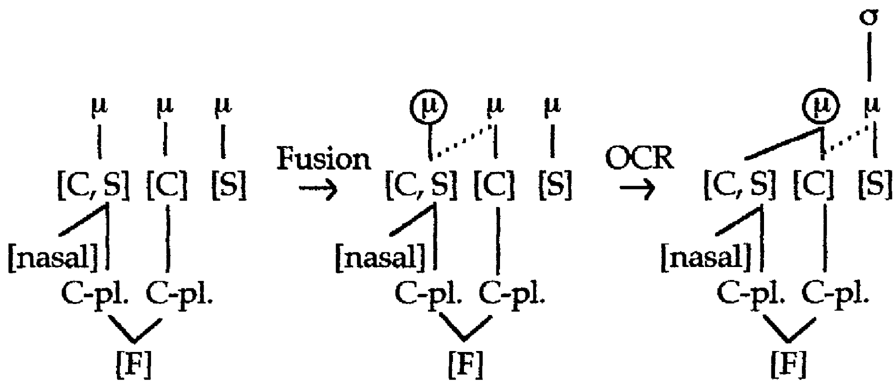
It is clear that the prenasalized obstruents are not to be treated as a single segment underlyingly. Therefore the syllabification of the prenasalized obstruents requires an extra rule, in addition to the OCR, and is subject to certain conditions.

There seem to be two possible candidates for another rule; one is the Onset Adjunction Rule (OAR) as advocated by Hyman, the other what might be called 'Fusion'. A [C, S]-[nasal] segment undergoes the OAR, while Fusion operates on a [C, S]-[nasal][C] sequence. The processes involved in the two rules are illustrated in (21) and (22) respectively.

(21) OCR and Onset Adjunction Rule



(22) Fusion and OCR



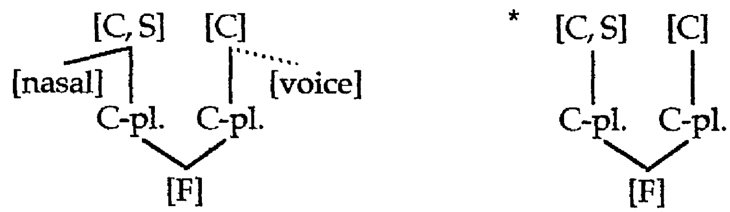
One crucial difference between these two possible rules is the rule ordering. The OAR happens after the OCR takes place, while Fusion occurs before the OCR. Since the OCR is regarded as a universal rule, the occurrences of any rule before it should be avoided. Moreover, under Hyman's theory, only a [C] segment undergoes the OCR. Thus the OAR should be chosen as the additional rule required for the syllabification-related processes for the prenasalized obstruents.

The OAR is a language-specific rule, and so KiMvita must specify some conditions under which it may or may not occur. Two conditions must be set up so that the OAR will not create ill-formed structures in KiMvita. One of these is the Feature Linkage device and the other is the minimal word size constraint (abbreviated to MWSC). Firstly, Feature Linkage (FL) is discussed.

FL between a nasal and an obstruent must be found in order that the OAR can apply. FL must be understood as a diacritic device in KiMvita which expresses the 'necessary homorganicity' between a nasal and a following obstruent in terms of place of articulation. Thus, even if two consonants happen to share the same place of articulation, no FL is necessarily found in such a sequence. The restriction of FL to prenasalized obstruents prevents word-initial or word-internal consonant sequences found in loanwords from undergoing the OAR: for example, /bin̪t̪i/ 'daughter', /st̪eʃeni/ 'station', etc. Moreover, such sequences are always understood to consist of a moraic consonant and a nonmoraic consonant. A consonant sequence other than a N+C sequence realized as a prenasalized obstruent must be excluded from having FL. Hence a structure such as that given in (23b) would not be permissible. Furthermore, a sequence consisting of a nasal followed by a voiceless obstruent should also be excluded; a [C] segment is understood to be a voiced obstruent, which is expressed by linking to a [voice] feature via the laryngeal node.

(23)

a. b.



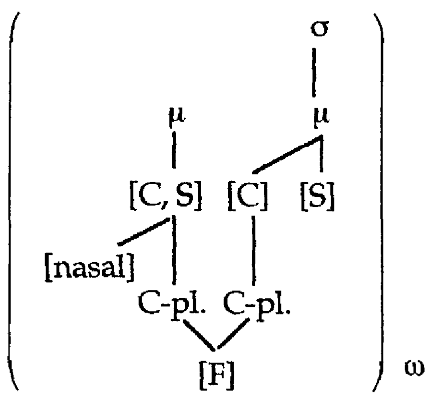
In KiMvita, FL is confined strictly to N+C sequences which are realized as prenasalized obstruents.

The second condition concerns the monomoriac-stem items. In order to fulfil the MWSC, which requires 'two morae' in KiMvita, a certain structure should be in place by the time the OAR takes place. Monomoraic stem items of Cl. 9/10 are such cases; for example, /N-ge/ [ŋge] 'scorpion', /N-bu/ [m̩bu] 'mosquito', /N-pya/ [m̩pʰʲa] 'new' and so on. As the pronunciation of these words explicitly demonstrates, place feature spreading has taken place. For example, in a word such as [ŋge], the nasal prefix is realized as a velar nasal before a velar voiced stop. However, even though FL is expressed, the OAR should not occur in such cases, since the MWSC would be violated. In other words, the MWSC given in (24a) should be respected, hence a sequence such as N-CV depicted in (24b) may not undergo the OAR, even if FL is found. In (24), ω refers to a phonological word.

(24)

a. b.

(μ μ) ω



The structure in (24a) expresses the MWSC. Words containing this structure after the OCR has taken place do not undergo the OAR, even though FL is found.

Together FL and the MWSC predict that the following two cases are prohibited from undergoing the OAR: (i) monomoraic-stem items of Cl. 9/10 such as /N-ge/ 'scorpion' and /N-bu/ 'mosquito', which contain only two morae; (ii) words such as /m-buni/ (N. 3) 'coffee bush' which have the relevant sequence in terms of the major class features; e.g., [C, S][C][S][C, S][S], but do not have the place feature linkage between [C, S] and [C].

In sum, the OAR takes place when the following two conditions are fulfilled: (i) FL must be found between a nasal and the following obstruent; (ii) the MWSC should be respected. (ii) means that there should be at least three morae in the word after the OCR has applied to undergo the OAR.

4. 2. 2. 1. 3 The phonetic realization of voiced stops

I now look at the airstream mechanism, which is an important feature for distinguishing a voiced stop as a component of a prenasalized obstruent from that found in a sequence of a moraic nasal and a consonant.

KiMvita contains only one phoneme for each voiced stop as has been discussed in 3.3.3; however, there are two phonetic realizations: (ex)plosive and implosive.[22] Recall that in KiMvita the phonetic realization of a voiced stop is plosive when it is found as a component of a prenasalized obstruent or when it occurs in a 'coda' position, whereas it is implosive when the voiced stop is exclusive to an onset. The airstream mechanism (ASM), either egressive pulmonic (hereafter 'EP') or ingressive glottalic (hereafter 'IG'), determines either a plosive stop or an implosive stop. This is assigned by rules in the Phonetic Component (abbreviated to PC). In other words, ASM feature assignment takes place after syllabification, stress assignment, and other post-lexical rules have applied.

Provided that both [IG] and [EP] features are assigned by rules in the PC, the assumptions in (25) may be made.

(25) Assumptions

a. The [IG] feature is assigned to voiced stops exclusive to onset position.
b. The [EP] feature is assigned elsewhere.

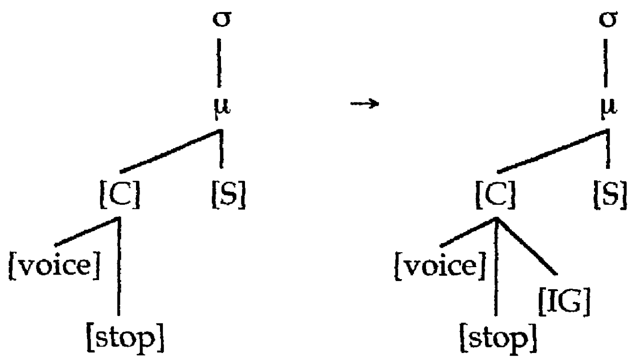
Assumption (25a) includes a voiced stop which is followed by a glide. Two segments which are affected by the assumption (25b) are: (i) the oral stop

[22] The term '(ex)plosive' (hereafter 'plosive') is used only in contrast with the term 'implosive' (see 2.1.1.2 and 3.3.3).

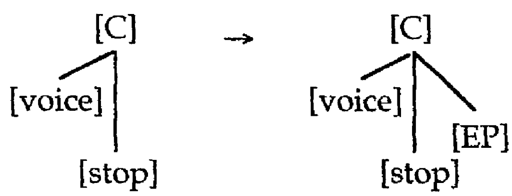
component of a prenasalized stop, i.e., C of ^{N}C; (ii) a voiced stop in 'codas', i.e., C of VC. (where . is a syllable boundary).

In the PC, the assumptions in (25) require two rules. They are given in (26) and (27), where the [stop] feature and the [voice] feature are understood to be associated with a root node via the oral cavity node and the laryngeal node respectively for ease of exposition. Moreover, the ASM features are assumed to be dependents of the root node.

(26) The [IG] feature assignment



(27) The [EP] feature assignment

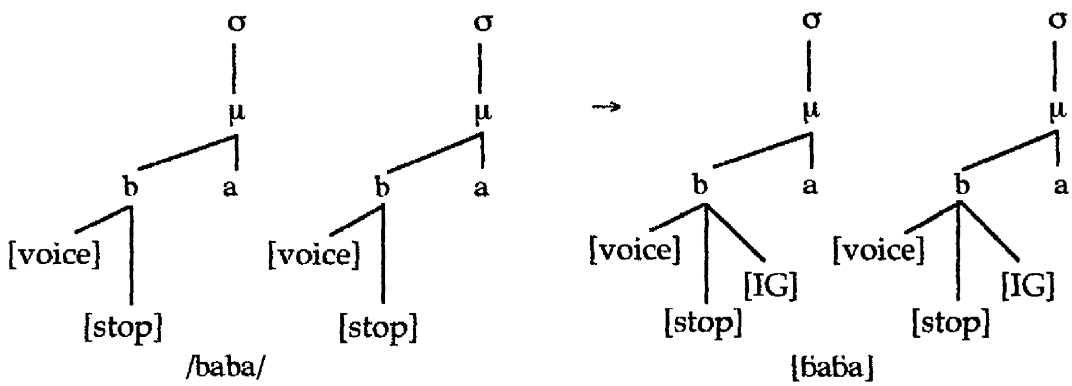


The case of monomoraic-stem items in Cl. 9/10 should be noted. Recall that the distinction between a sequence of nasal and voiced stop in word-initial position, either as a prenasalized stop or as a moraic nasal followed by a voiced stop, is performed by Feature Linkage (FL) device; this applies in the former but not in the latter case. This FL device plays an important role when a monomoraic-stem item is syllabified; FL between two segments prevents the [IG] feature from being assigned to a voiced stop, although in such a case a voiced stop appears to be an onset position exclusively.

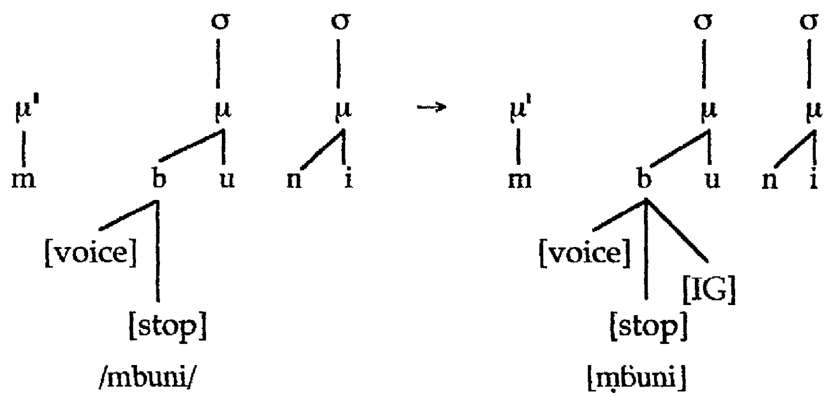
Based on these rules, the words /baba/ (N. 9/10) 'father' and /mbuni/ (N. 3) 'coffee bush', which undergo the rule in (26), are diagrammed as in (28).

(28)

a. /baba/ 'father'



b. /mbuni/ 'coffee bush'

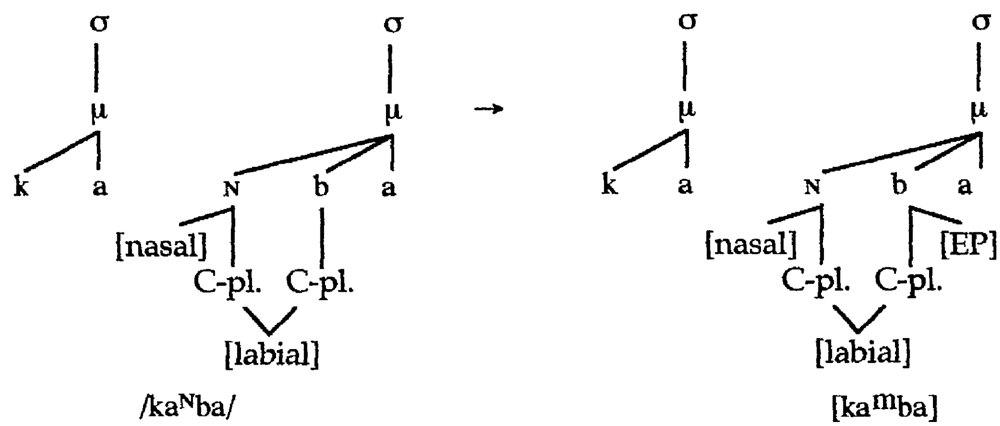


In (28a), both /b/'s in /baba/ are exclusive to an onset position and in (28b), FL is not found in a N+C sequence /mb/, and /b/ is found to be exclusive to an onset position. Thus all three voiced stops in (28) are implosive.

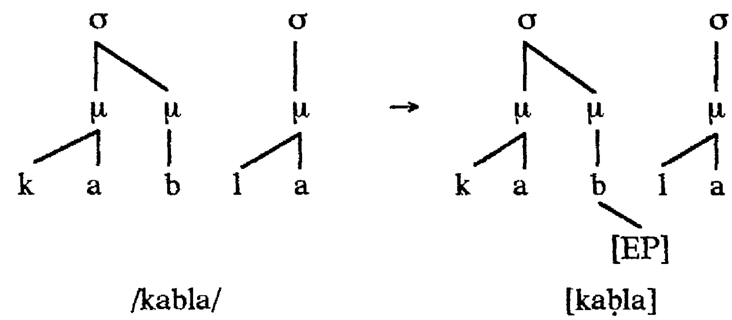
The words /ka^{N}ba/ (N. 9/10) 'rope', /kabla/ (Adv.) 'before' and /N-bu/ (N. 9/10) 'mosquito', which undergo the rule in (27), are depicted in (29), where [voice] and [stop] features are assumed to be present, although for convenience I have omitted them.

(29)

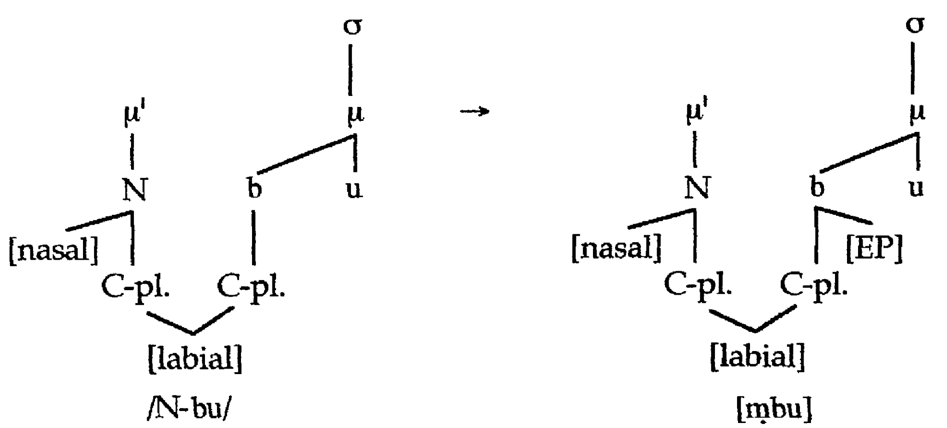
a. /kaNba/ 'rope'



b. /kabla/ 'before'



c. /N-bu/ 'mosquito'



(29c) shows the case in which the [EP] feature is assigned to a voiced stop although it is exclusive to an onset position, since a voiced stop is feature linkaged with a preceding nasal. In (29a) and (29b), voiced stops are not exclusive to an onset position; namely, a voiced stop component of a prenasalized stop and a voiced stop in a 'coda' position. Hence they are phonetically realized as plosive.

In sum, the [IG] feature is assigned to a voiced stop which is exclusive to an onset position as in (26); thus the voiced stops /b, d̪, d, ɟ, g/ found in such a position, except for monomoraic-stem items in Cl. 9/10, are realized as [ɓ, ɗ̪, ɗ, ʄ, ɠ]. On the other hand, the voiced stops found elsewhere, i.e., either a voiced stop in a ^{N}C or that in a 'coda' position, acquire the [EP] feature as in (27), hence they are realized as plosive stops, [b, d̪, d, d͡ʒ, g]. In addition, a voiced stop found in a monomoraic-stem item in Cl. 9/10 is realized as plosive even though it appears to be exclusive to an onset position, since FL is seen between a nasal and a voiced stop.

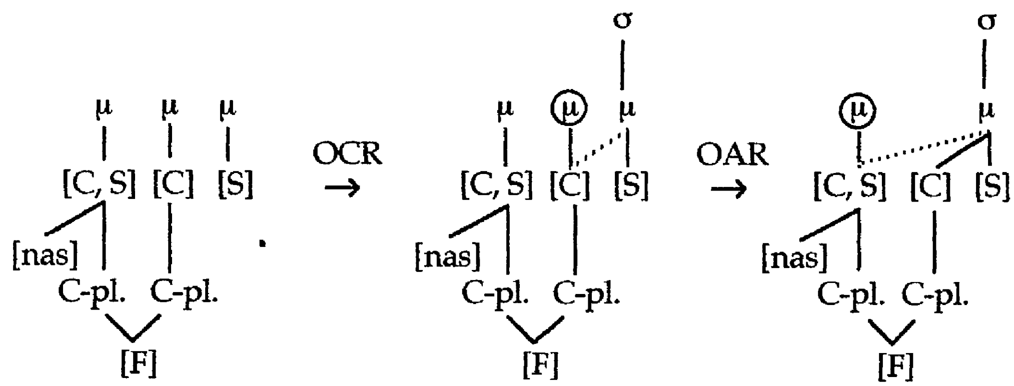
4. 2. 2. 1. 4 The syllabification-related processes

Two rules, the OCR and the OAR, along with FL and the MWSC are required for the syllabification of prenasalized obstruents regardless of their underived/derived status. The existence of FL allows the OAR to take place unless the MWSC is violated. Regarding the phonetic realization of a voiced stop of a ^{N}C, its plosiveness is obtained by the [EP] feature assignment rule specified in (27). The existence of FL prevents the [IG] feature from being assigned to a voiced stop, even though the voiced stop appears to be exclusively in an onset position, as happens in the case of monomoraic-stem items in Cl. 9/10.

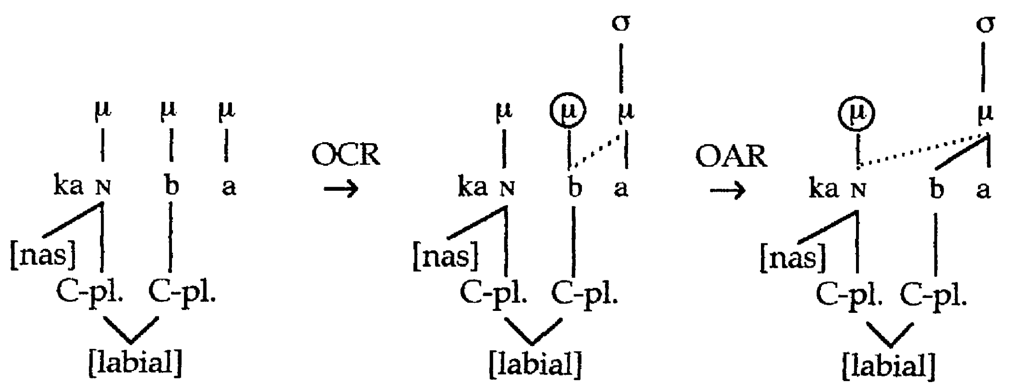
The syllabification-related processes for underived and derived prenasalized obstruents are depicted in (30a) and (31a) respectively, where a [C] refers to a voiced stop; (30b) and (31b), where root nodes are replaced by phonemic transcriptions, provide exemplification. Regarding the feature organizations, only the essential parts are shown. In addition, the ASM feature assignment occurs to (voiced) stops of prenasalized obstruents only in the PC. This is not shown in the diagrams.

(30) Underived prenasalized obstruents

a.

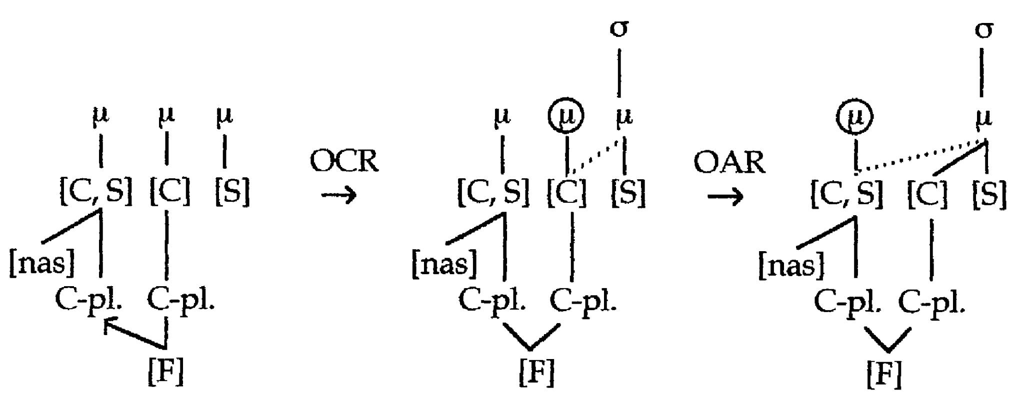


b. /ka^{N}ba/ 'rope'

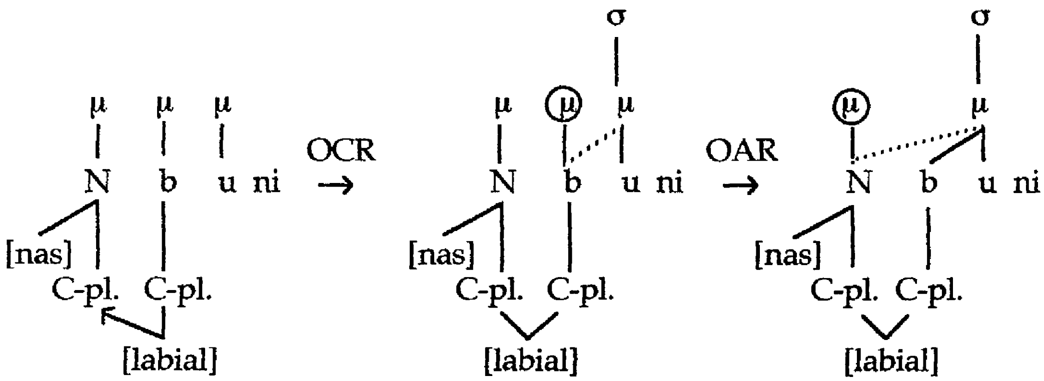


(31) Derived prenasalized obstruents

a.

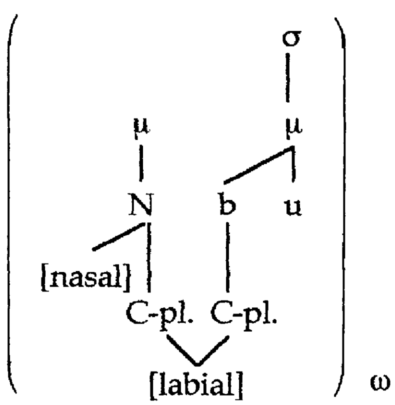


b. /N-buni/ 'ostrich'



However, in the case of monomoraic-stem items such as /N-bu/ [m̩bu] 'mosquito', they exhibit a structure as in (24b) above, which may not undergo the OAR. The structure of /N-bu/ is given in (32), where ω refers to a phonological word.

(32)

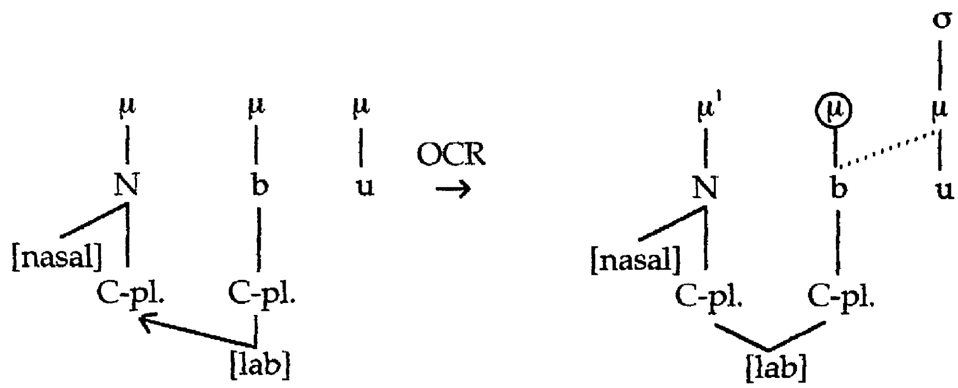


The structural description (24b) above implies that at least three morae are required after the OCR has taken place in order that a nasal can undergoes the OAR. However, as can be seen in (32), there are only two morae left after the OCR has applied to the sequence /bu/ of the monomoraic-stem noun /N-bu/.

In order to comply with the MWSC for KiMvita, the OAR does not operate on a nasal prefix of a monomoraic-stem item, although one of the unification processes, feature spreading, does occur. Since the stress bearer is the penultimate mora - not the syllable - in KiMvita, as has been discussed in 3.5, monomoraic-stem items need to retain two morae to compose a minimal foot so that stress assignment can take place. Among such monomoraic-stem items, the only possible candidate for retaining a mora in order to carry stress is the nasal component of the prenasalized obstruent, i.e., the nasal prefix.

A syllable structure for the word containing the monomoraic stem /N-bu/ is depicted in (33), where μ' indicates an unsyllabified mora. The syllabification affecting moraic nasals is discussed in greater detail below, hence the diagrams here are incomplete.

(33)



In (33), it can clearly be seen that the OAR does not take place because the nasal retains its own mora in order to fulfil the MWSC, even though FL has been established. As a consequence, the nasal assimilates to the place feature of the following obstruent, /b/. Regarding the ASM feature, although a voiced stop /b/ in this example appears to be exclusive to an onset position, it is still linked to the nasal component, and therefore it does not receive the [IG] feature assignment in the Phonetic Component (PC).

To sum up so far, the prenasalized obstruents regardless of their underived/derived status show FL, viz., the place feature is shared by a nasal and a following obstruent. In the case of derived prenasalized obstruents found in Cl. 9/10 items, the nasal prefix /N-/ is partially specified, and thus the place feature needs to be filled by spreading of the feature from the following obstruent. As a result, FL is established. The existence of FL between a nasal and an obstruent allows a sequence to undergo the OAR, which follows the OCR. However, the OAR does not always take place even if FL is present between a nasal and an obstruent. This is because the MWSC has to be respected. Moreover, the existence of FL subsequently (in the PC) prevents the ASM feature [IG] from being assigned to a voiced stop of a prenasalized obstruent, even when the nasal and the voiced stop appear to be in distinct syllables.

There is no such linkage found in a sequence of a fully specified moraic nasal and a following consonant, thus no OAR takes place. In the following subsection, the syllabification of such sequences is considered.

4. 2. 2. 2 The syllabification of moraic nasals

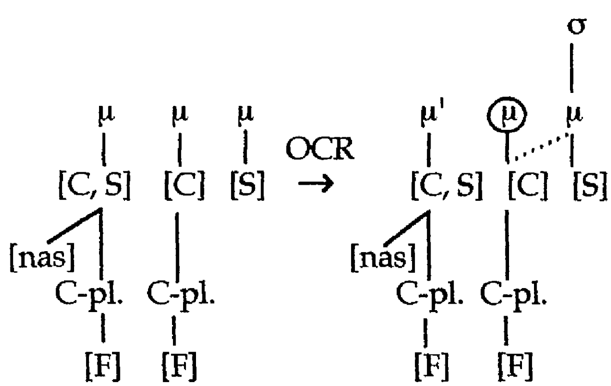
The moraic nasals, except for post-vocalic moraic nasals found in Arabic loans such as /manðari/ (N. 11) 'view', have two sources in KiMvita: [m̩] (<*/mu/) or [n̩] (← /ni/) in various morphemes such as the 1st sg. verbal agreement, copular constructions, etc. (see 3.2.3); and /N-/, the nasal prefix of Cl. 9/10 in one particular environment; viz., monomoraic-stem items. The first cases may occur either as stress bearers or as non-stress bearers, but the last-mentioned is always a stress bearer. In the following subsections the syllabification of the unstressed and the stressed moraic nasals is investigated.

4. 2. 2. 2. 1 The syllabification of unstressed moraic nasals

The syllabification-related processes of words containing an unstressed moraic nasal uttered in isolation and of those within utterances are to be examined. The syllabification of a sequence such as N+C+V in which C is any consonant is illustrated in (34a) and the word /mbuni/ (N. 3) 'coffee bush' is exemplified in (34b).

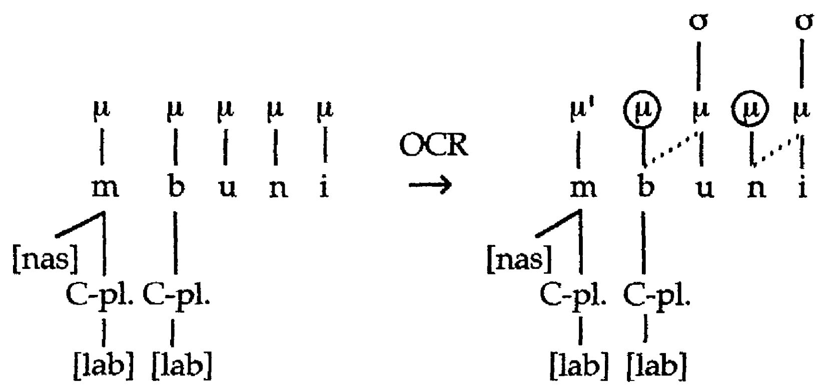
(34) Unstressed moraic nasals

a.



(μ' indicates an unsyllabified mora)

b. /[m̩]buni/ 'coffee bush'



Since the place feature of the moraic nasal is fully specified underlyingly, no FL between the nasal and the following obstruent is found. Thus, the moraic nasal does not undergo the OAR, as discussed above. As a consequence, the nasal remains unsyllabified, since a possible candidate for an onset consonant cannot be found. Moreover, if a possible nucleus were found, the nasal would lose its moraicity in undergoing the OCR. Regarding a voiced stop in a sequence of moraic nasal and consonant, in the Phonetic Component (PC), the [IG] feature will be assigned to the voiced stop, since there is a syllable boundary and the voiced stop appears to be exclusive to an onset. In (34b), /b/ is phonetically realized as [ɓ],

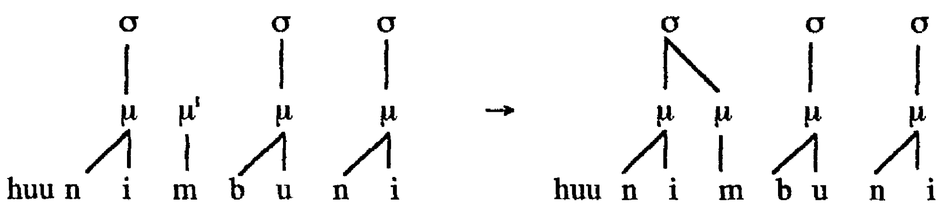
Next, the syllabification of the word /mbuni/ appearing in a sentence as in (35) needs to be investigated in terms of whether or not the moraic nasal is still unsyllabified.

(35) /huu ni mbuni/. 'this is a coffee bush.'

In (35), the word /mbuni/ is preceded by the copula /ni/, which cliticizes onto it since the monomoraic /ni/ cannot itself meet the MWSC. KiMvita phonology allows a bimoraic syllable, and hence it is reasonable to assume that the unsyllabified moraic nasal could be syllabified into the preceding syllable /ni/ as shown in (36b).

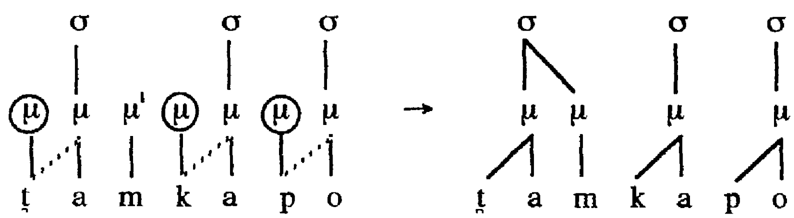
(36)

a. b.



A moraic nasal is also found in word-internal position, for example, /t̪amkapo/ 'when (I) pronounce'. Such a word-internal moraic nasal is also syllabified as the second mora of a bimoraic syllable, hence its syllable structure is as depicted in (37).

(37)



However, there might be a case in which a moraic nasal (or a vowel) in a phrase/sentence remains unsyllabified when it is preceded by a bimoraic syllable. For example, /m/ of /mkate/ 'loaf of bread' in a phrase /nunua mkate/ 'buy a loaf of bread' remains unsyllabified, thus /nu/$_σ$/nua/$_σ$/m//ka/$_σ$/te/$_σ$.[23]

In summary, on the one hand, a stressed word-initial moraic nasal is unsyllabified when it appears in isolation, since there is not possible candidate for an onset consonant. On the other hand, such a moraic nasal is syllabified as the second mora of a bimoraic syllable when it occurs in a phrase/sentence provided that it is preceded by a monomoraic syllable. However, such an unstressed moraic nasal remains unsyllabified when it is itself preceded by a bimoraic syllable. Likewise, with respect to an unstressed word-internal moraic nasal, it seems to be syllabified as the second mora of a bimoraic syllable.

Furthermore, feature specification of nasal prefixes is crucial to the phonetic realization of the following voiced stop. Since the features of a moraic nasal [m̩], unlike a nasal component of a prenasalized obstruent, are fully specified, no FL is seen between a sequence of a nasal and a consonant. As a

[23] The subject morpheme /i/ for /tʃai/ 'tea' in a sentence /tʃai hii i moto/ 'This tea is hot' is preceded by a bimoraic syllable /hii/ 'this', and therefore, it remains unsyllabified.

consequence, the OAR does not occur, and hence a syllable boundary appears between a nasal and a consonant. The [IG] feature is assigned to a voiced stop in a such a sequence by a rule in the PC. Hence, the phonetic realization of a voiced stop preceded by a moraic nasal is implosive, viz., [ɓ], [ɗ̪], [ɗ], [ʄ], or [ɠ].

4. 2. 2. 2. 2 The syllabification of stressed moraic nasals

The syllabification of a stressed moraic nasal is strongly related to the question of what is the stress bearer. In KiMvita, stress is borne either by a vowel or a moraic nasal with the exclusion of moraic alveolar nasals found in words of Arabic origin. Moreover, it may be borne by the second mora of a bimoraic syllable, for, unlike Japanese (see chapter 5), KiMvita phonology allows the second mora to bear stress, e.g., /t̪amka/ [t̪aḿ̩.ka] (V) 'pronounce'. In addition, when the stress is assigned to the second mora, the second mora does not need to construct an independent syllable to bear it. In other words, no resyllabification processes are required when the second mora becomes the stress bearer.

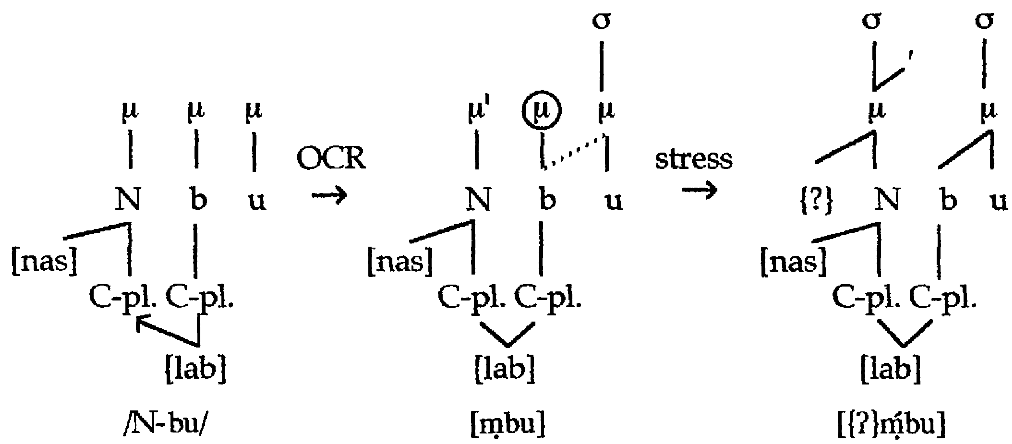
Stressed moraic nasals are found in five environments: (i) a nasal prefix of a monomoraic-stem item of Cl. 9/10; (ii) a word-internal moraic nasal, which is followed either by a voiceless obstruent or by a nasal/liquid; (iii) a nasal prefix of a monomoraic-stem noun of Cl. 1 or 3, e.g., /[ḿ̩]tʰu/ 'person' or /[ḿ̩]ti/ 'tree'; (iv) the 3rd.sg.obj. pronoun /m/ with a monomoraic-stem verb in the imperative form, such as /[ḿ̩]pe/ (← /pa/ 'give') 'give him!'; (v) words such as /[ń̩]ne/ 'four' etc. At this point, I shall examine the words /N-bu/ (N. 9/10) 'mosquito' (both on its own and in a sentence) and /t̪amka/ 'pronounce'.

(38)

a. /N-bu/ 'mosquito'
b. /huu ni N-bu/ 'This is a mosquito.'
c. /t̪amka/ 'pronounce'

Firstly, the pronunciation of the word /N-bu/ uttered in isolation and that of the word /t̪amka/ are examined. These two words differ from each other in terms of the position of the moraic nasal, i.e., word-initial or word-internal. According to the pronunciation of my informant, glottal stop epenthesis is heard before the word-initial stressed moraic nasal when it is uttered in isolation: [{ʔ}ḿ̩bu] (where { } indicates an epenthetic segment). However, such glottal stop epenthesis is not heard in the word-internal stressed moraic nasal, hence [tam̩ka]. The syllabification-related processes of these two words are shown below.

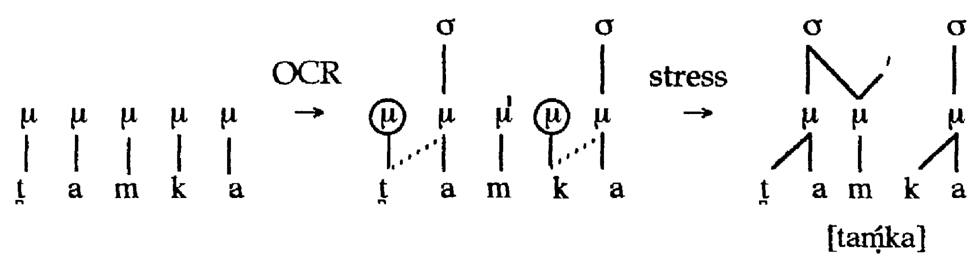
(39) /N-bu/



({ } indicates an epenthetic segment)

In (39), the moraic nasal, [m̩], is syllabified, since an epenthetic glottal stop plays a role as an onset. Such syllabification is found in the post-lexical phonology. However, the construction of a syllable is not due to the nasal being a stress bearer. Rather, it is simply dependent on the existence of a glottal stop as an onset. However, if glottal stop epenthesis did not occur, a stressed moraic nasal would remain unsyllabified; as has been discussed in the previous subsection, there is no possible candidate for an onset consonant. A word-initial stressed moraic nasal is generally found in monomoraic-stem items of Cl. 9/10 and FL occurs between the nasal and the following obstruent. In the Phonetic Component, FL will enable the [EP] feature to be assigned to the voiced stops, even though a syllable boundary is seen between the two segments, i.e., the voiced stop is exclusive to an onset position. As a consequence, the voiced stop in the word /N-bu/ is pronounced as plosive, [b].

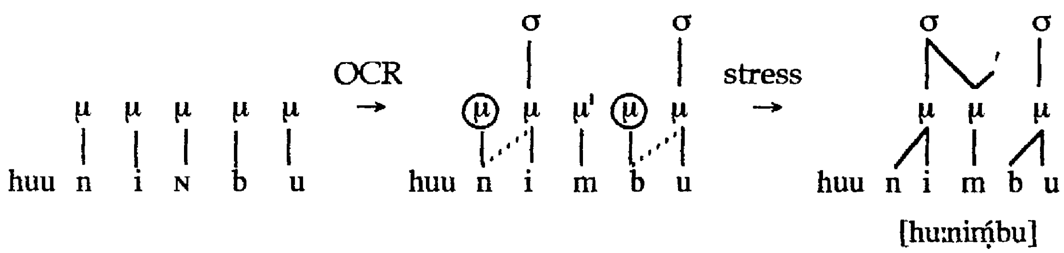
(40) /t̪amka/



In (40), no 'homorganicity' is found within the consonant sequence of /m/ and /k/, therefore the consonant /m/ remains moraic and is counted as the penultimate mora, to which stress is assigned in the post-lexical phonology. Although it appears as the second mora of a bimoraic syllable, it is not necessary to construct an independent syllable, since, as has been discussed, the stress bearer is the mora in KiMvita.

When the word /N-bu/ occurs in a sentence as in (38b), a glottal stop is no longer heard as it is when uttered in isolation. The stressed moraic nasal is syllabified as the second mora of the preceding syllable which a mora linked to /ni/ has constructed. As in the word /t̪amka/ in (40), the moraic nasal is associated with the second mora, to which stress is assigned in the post-lexical phonology. The syllable structure is displayed in (41), where the feature organization is omitted for ease of exposition.

(41) /huu ni N-bu/



To sum up, when the stressed moraic nasal is found word-initially and is uttered in isolation, an epenthetic glottal stop is heard, unlike the case of the unstressed word-initial moraic nasal discussed above. It can construct a syllable since there is an available onset, i.e., an epenthetic glottal stop. However, constructing an independent syllable is not essential in order to bear the stress. When the stressed moraic nasal is found in word-internal position, or within an utterance, it is always associated with the second mora of a bimoraic syllable, unless the preceding syllable is bimoraic.

4. 2. 2. 3 The syllabification of moraic consonants

The great degree of Arabic influence led to the addition of many words containing consonant sequences to the words of Sabaki origin in KiMvita. As a predominantly CV language, the phonology of KiMvita historically did not allow consonant sequences other than those involving a sequence of a nasal and a consonant. The language therefore employed vowel insertion to break consonant clusters or added a vowel to a word-final consonant when one was encountered in a loanword (Tucker 1943-46: 855-856). For example, /labd̪a/ 'probably' in Standard Swahili is only pronounced [labd̪a]. However, in

KiMvita that pronunciation is regarded as alternative and is a rarely heard one; the most attested pronunciation is [laɓuḍa].

As mentioned in 3.5, although KiMvita prefers vowel epenthesis to keep a CV sequence, alternative pronunciations are sometimes heard. The word in (42b), for example, has a variant. The vowel epenthesis of /i/ after /d̪/ seems to be preferable in KiMvita, hence /ahmad̪i/, even though /ahmad̪/ is also acceptable by virtue of the prestigious on-going influence of Arabic on the pronunciation.[24] As this variant shows, vowel insertion does not always happen, and consequently, consonant clusters remain intact. As a result, the leftmost consonant of a cluster or a word-final consonant is realized as moraic.

Examples of the consonants /b, d̪, f, s, ʃ, k, h, l, r, n/ as moraic are found in words of Arabic origin given in (42).[25]

(42)

a.	/kab.la/	'before'
b.	/ah.mad̪/	'personal name'
c.	/kuf.ru/	'apostasy from Allah'
d.	/mas.ki.ni/	'poor'
e.	/maʃ.t̪a.ka/	'accusation'
f.	/mak.t̪a.ba/	'library'
g.	/al.ha.mi.si/	'Thursday'
h.	/ar.bai.ni/	'forty'
i.	/man.ða.ri/	'view'

(. indicates a syllable boundary)

A syllable boundary comes within consonant clusters and all the leftmost members of clusters are realized as moraic.

Moraic consonants found in words of Arabic origin usually appear word-internally and word-finally. Regarding word-initial consonant sequences, which are mainly found in borrowings from languages such as English. They are dealt with later (see 4.2.2.3.2).

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[24] In addition to this, a word *rais* 'president', found in Standard Swahili, gets a vowel insertion and is realized as /raisi/ in the preferred KiMvita pronunciation.

[25] Not many words contain a post-vocalic moraic *n*: e.g., /hasant̪a/ 'thanks', /bint̪i/ 'daughter', /manðari/ 'view', etc. English words such as 'bank' and 'blanket' are realized as /be^{N}gi/ and /bura^{N}get̪i/ respectively. However, in Standard Swahili, an underlying post-vocalic moraic nasal is sometimes found in words of English origin; they are realized as *banki* or *benki* and *blanketi*.

4. 2. 2. 3. 1 The syllabification of word-internal/-final moraic obstruents

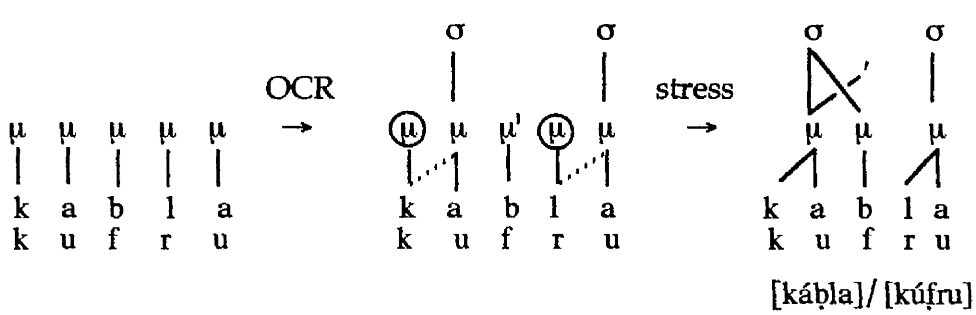
The details of the syllabification of post-vocalic consonants depend upon whether or not the Margin Creation Rule (MCR) takes place. In the words of Sabaki origin, a consonant found in a post-vocalic position is a nasal or possibly a liquid /l/[26], while in words of Arabic origin , the consonants /b, d̪, f, s, ʃ, k, h, l, r, n/ are found in such a position. As Park (1997) discusses, post-vocalic consonants are counted as moraic (syllabic in Park's terms) in various phonological phenomena such as stress assignment, word games, poems, and so on. Thus, these consonants clearly do not undergo the MCR depicted in (43), and hence retain their own mora. I shall repeat the MCR in 2.4.2.2 here.

(43) Margin Creation Rule

a. b.

Since a bimoraic syllable is also a member of the syllable inventory in KiMvita, the second mora in a bimoraic syllable may consist of any mora that has survived the operation of the OCR. In addition, allowance of a bimoraic syllable type in the syllable inventory does not require us to look for a possible epenthetic segment with which a moraic consonant could constitute a syllable. In fact, such an epenthetic segment is never found. Hence, /kab/ of /kabla/ and /kuf/ of /kufru/ constitute bimoraic syllables as in (44), in which the moraic consonants, [b̩] and [f̩], are associated with the second mora of a bimoraic syllable, like the moraic labial nasals discussed above.

(44) /kabla/, /kufru/

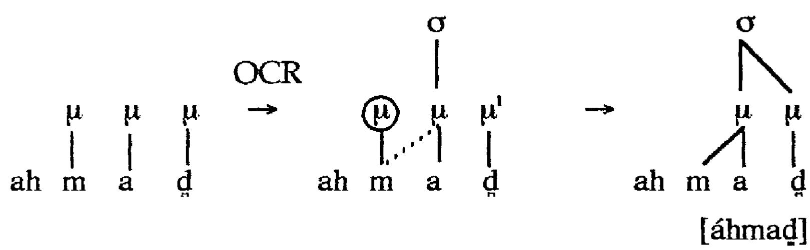


[26] A post-vocalic /l/ is found in the word /mfalme/ 'king', which is an alternative form of /mfaume/ (< */mfalume/ historically).

Recall that the moraic consonants may not bear stress, unlike the moraic labial nasals found in words of Sabaki origin in addition of the Cl.9/10 nasal prefix with monomoraic stem. As has been discussed in 3.5, they are subject to stress shift. Therefore the preceding mora associated with a vowel bears stress in these words, /kabla/ and /kufru/; thus [káḅla] and [kúf̣ru]. Significantly, my informant does not pronounce stressed vowels that are durationally longer. This is because the stressed vowel is already in a bimoraic syllable, hence no additional phonological lengthening could occur (see Appendix B for a phonetic experiment demonstrating this). Furthermore, the phonetic realization of /b/ is not implosive but plosive. It is treated as an allophone of the underlying voiced bilabial stop phoneme.

In the case of the word-final moraic obstruents, the same manner of syllabification is postulated, thus:

(45) /ahmad̪/



4. 2. 2. 3. 2 The syllablification of word-initial consonant sequences

Alongside a few words of Arabic or Hindi origin such as /st̪aafu/ 'retire from employment' or /pleki/ 'metal put onto clothes for decoration' respectively, recent borrowings, especially from English, have created consonant sequences in word-initial position. Examples are shown in (46), where the sequences are boldfaced.

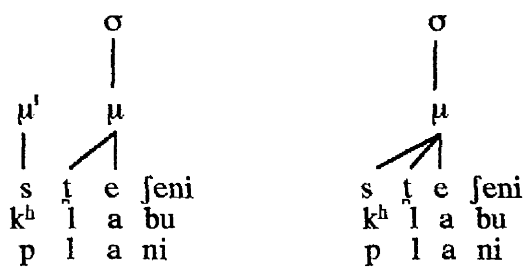
(46)

a. /**st̪**eʃeni/ 'station'
b. /**kʰl**abu/ 'club'
c. /**pl**ani/ 'plan'

There are two possible analyses for the syllabification of such word-initial consonant sequences, as shown in the diagrams in (47), (only the relevant parts of syllable structures are given).

(47)

a. b.



In (47a), the leftmost consonant of such a consonant sequence remains unsyllabified, whereas in (47b), it appears to have undergone the Onset Adjunction Rule (OAR); this is not the case as we will see shortly.

The consonant sequences under discussion are /st̪/, /kʰl/ and /pl/. We know that the consonant sequences *kl* and *pl* are permissible complex onset consonants without any special treatment in English. However, KiMvita does not allow consonant sequences except for N+C sequences. As has been discussed, the prenasalized obstruents undergo the OAR on conditions that there is Feature Linkage (FL) between the two segments and that the MWSC is respected. Nevertheless, the OAR could not be taken into consideration in the cases of the word-initial complex onset consonants such as given in (46), since there is no such FL between the two segments. As discussed above, FL occurs only between a nasal and a following (voiced) obstruent segment, which create a prenasalized obstruent, regardless of the position they appear in. Even if two adjacent segments in any position happen to share the same place feature, FL would not necessarily be seen as operating.

It is plausible to assume that in any consonant sequence other than N+C sequences with having Feature Linkage, the leftmost consonant appears to be moraic, as in the case of word-internal consonant sequences, or that insertion of the vowel /i/ or /u/ could occur within such a consonant sequence. According to my informant, no such epenthetic vowel is found in these rather recent borrowings; thus, */s-i/u-teʃeni/, */kʰ-i/u-labu/ or */p-i/u-lani/, although the English word 'blanket' gets vowel epenthesis within a word-initial consonant sequence, and the consonant /l/ is changed to /r/; thus the output is /bura^{N}get̪i/ in KiMvita.

Observations seem to lead to a conclusion that the leftmost consonant of word-initial consonant sequences is regarded as moraic and may remain unsyllabified. Moreover, we could assume that there would also not be a possible candidate for an onset for a word-initial moraic consonant. With respect to words of Arabic and Hindi origin containing word-initial consonant clusters such as /st̪aafu/ 'retire from employment' and /pleki/ 'metal put onto clothes for decoration', the same analysis is applicable. Syllable structures for the examples, /k^{h}labu/ and /st̪aafu/ are depicted as in (48), in which the leftmost consonants of the consonant clusters remain unsyllabified.

(48)

a. b.

When these words appear in a sentence, it can be expected that unsyllabified moraic consonants are associated with the second mora of any word that precedes them, providing it contains a final monomoraic syllable as in the case of unsyllabified moraic labial nasals discussed in 4.2.2.2.

A representation of a long vowel depicted in (48b), where two distinct vowels are associated with distinct morae, is how the theory employed here represents Park's (1997) claim that in Standard Swahili each vowel of a sequence, including identical vowels, is the nucleus of a distinct syllable. Park employs a language game to prove that a sequence of two identical vowels can in fact be separated by an insertion of a CV suffix *cha*. For example, a word *kaa* 'crab' becomes *cha-ka-cha-a*.[27] Thus Park concludes that a long vowel consists of two monomoraic syllables; i.e., that the second vowel constitutes a syllable without an onset segment in his analysis. However, an onsetless syllable is not allowed under the present theory. Hence a representation of a long vowel is as in (48b); viz., the association of two segmental matrixes with distinct morae within a bimoraic syllable. Although my informant does not recognize such a language game, this line of treatment of a long vowel is not implausible if applied to KiMvita.

4. 2. 3 The Syllabification of C+G Sequences

In KiMvita, as we have discussed in chapter 3, a post-consonantal high vocoid is regarded as a component of a complex nucleus, i.e., a light diphthong. Any discussion about syllabification involving a post-consonantal high vocoid must

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27 In KiMvita, the word /kaa/ means 'piece of charcoal', and the word /k^{h}a^{N}ba/ conveys the meaning of 'crustacean'.

therefore include the following vowel. However, there are exceptional sequences /ny/, /fy/ and /vy/, which are derived as a consequence of causative formation, and such sequences are regarded as phonemes. Thus, they require a process for creating a complex consonantal segment (hereafter complex segment).

The syllabification-related processes for a sequence of CGV (shorthand for [C, (S)][S]-[high][S]) reveal three cases: (i) for a [S]-[high][S] sequence of CGV that forms a light diphthong; (ii) for a [C, (S)][S]-[high] sequence of CGV that forms a complex segment, C^G; and (iii) for a [S]-[high][S] sequence of CGV that forms a vowel sequence. The second case concerns only a derived complex segment such as [ɲ], [fʲ] and [vʲ] in a causative form. Lexical occurrences of the phonemes /ɲ/, /fʸ/ and /vʸ/ are not obtained from syllabification-related processes, since they are underlying. The third case is found in words such as /amua/ 'separate persons fighting', /barua/ 'letter', /kiatu/ 'footwear', etc.

Discussion will proceed based on: (i) the assumptions for syllabification under the current theory as stated in 2.4.1: (ii) the assumption of the treatment of glides in KiMvita discussed in 3.3.2.4 and 3.3.2.5: (iii) the assumption of the revised OCR as discussed in 4.2.1. I shall repeat these assumptions of (i) and (ii) below.

(49)

a. Syllabification takes place strictly left to right.
b. The OCR is the first rule to apply.
c. The case is one where a glide is regarded as a component of a light diphthong.

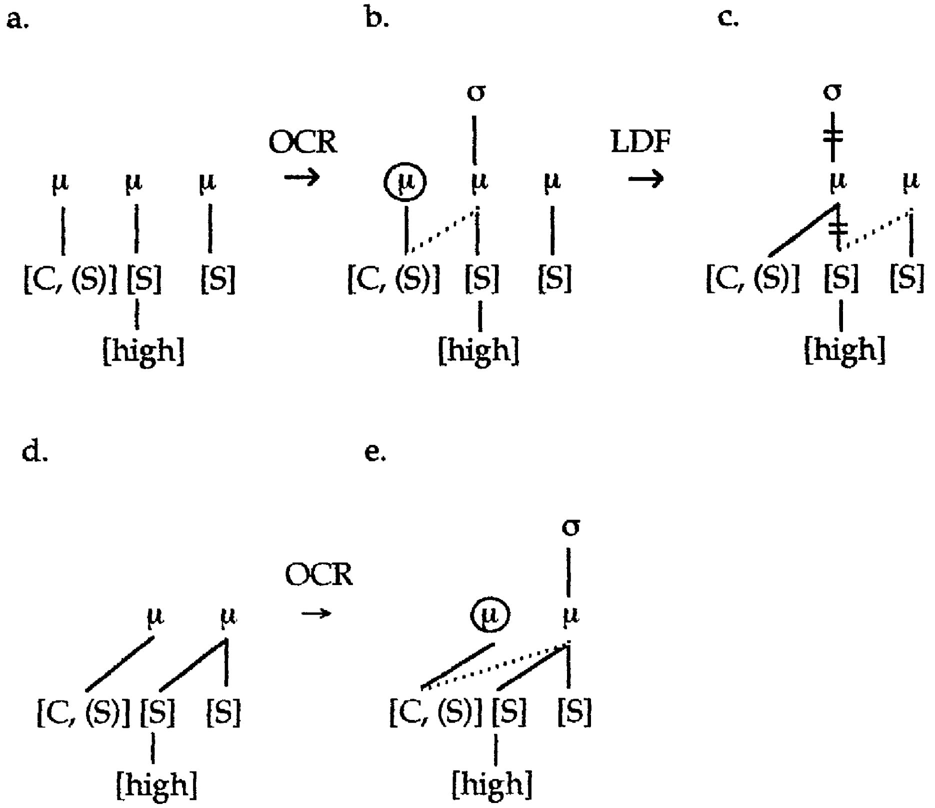
Firstly, I deal with the syllabification-related processes for a sequence involving light diphthong formation. This is compared to the case where a sequence of [S]-[high][S] does not form a light diphthong, but remains as a sequence. This is followed by discussion of the processes of syllabification for a sequence involving a complex segment. The appropriate internal organization of a complex segment will be considered for a CGV sequence involving a light diphthong alternating with a secondary articulation, which is heard when an stressed vowel immediately precedes such a sequence; for example, /amwa/ as [ámʷa]. Finally, the syllabification-related processes involved in a sequence of NCGV will be considered.

4. 2. 3. 1 The syllabification of light diphthong and vowel sequences

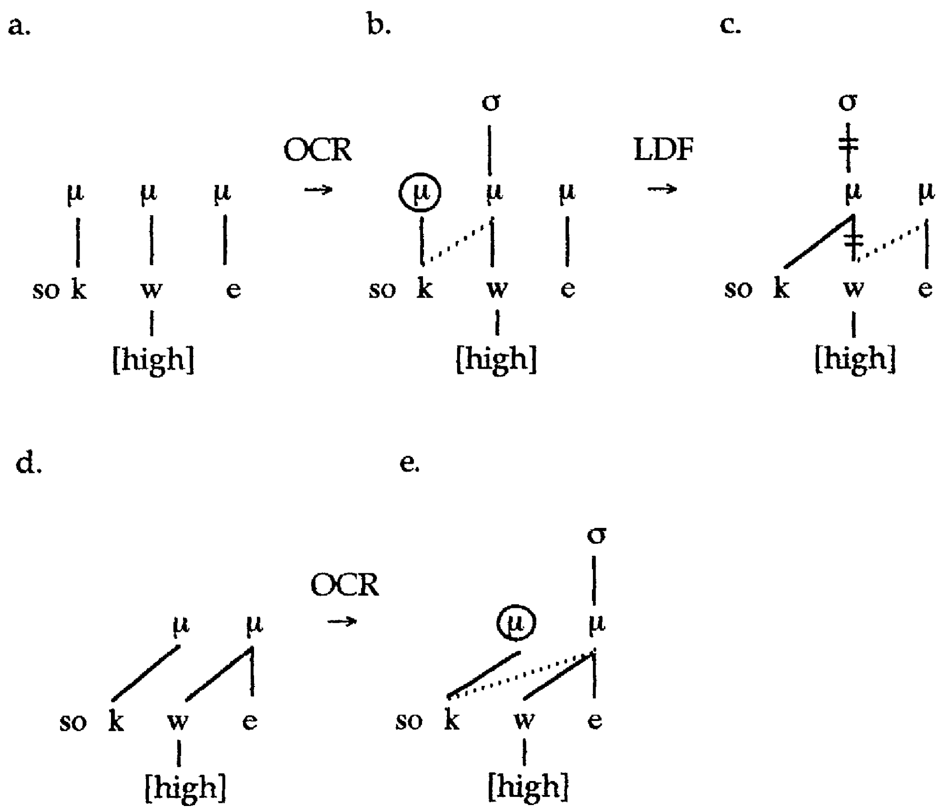
On the basis of the assumptions in (49) and the revised OCR, the syllabification-related processes for a sequence involving a light diphthong starts with the OCR which applies to a sequence of [C, (S)] and [S]-[high]. Then Light Diphthong Formation (LDF) takes place between the [S]-[high] segment (G) and the following V, except when the G and the V share both the same articulator and the same height, i.e., */yi/ and */wu/. Thus CGV sequences in words such as /t^hwiga/ (N. 9/10) 'giraffe', /sokwe/ (N. 9/10) 'chimpanzee', etc. may undergo LDF.

In the operation of LDF, a [S]-[high] segment dissociates from its mora and is linked to the following mora associated with the [S] segment. As a result of a [S]-[high] segment dissociating from its mora, the syllable node delinks automatically from that mora. It is clear that LDF occurs only when a [S]-[high][S] sequence is preceded by a [C, (S)] segment; otherwise such a sequence would undergo the OCR in accordance with the revision stated in 4.2.1. Moreover, LDF must be differentiated from the OCR with regard to the mora, from which a segment has been dissociated, since it is not deleted in the course of LDF. Thus, after LDF has occurred, the [C, (S)] segment remains linked to the mora from which the [S]-[high] segment dissociated, and hence there are still two morae. The two-mora sequence allows the OCR to take place again; this time a mora associated with the [C, (S)] segment and a mora which is linked to a light diphthong, [S]-[high][S], undergo the OCR. This process is diagrammed in (50). The word /sokwe/ (N. 9/10) 'chimpanzee' is exemplified in (51), (only the relevant structures are shown).

(50)



(51)



According to (50b), as a result of the OCR a sequence of [C, (S)][S]-[high] constitutes a syllable, however, dissociation of [S]-[high] from its mora also induces delinking of a syllable node, as in (50c). (50d) displays the structure after dissociation of a syllable node from its nuclear mora, from which the [S]-[high] segment dissociates. LDF occurs as a result of the [S]-[high] segment linking to the same mora with which the [S] feature is associated. Finally, the two morae linked to [C, (S)] and the light diphthong respectively undergo the OCR, and consequently, a [C, (S)][S]-[high][S] sequence is realized as a sequence containing a light diphthong.

At first glance, the first OCR might not seem to be necessary. However, it not only fulfils the assumptions (49a) and (49b), but it also differentiates in a plausible way LDF from the process of forming a complex (consonantal) segment; this is dealt with shortly.

The next concern is the syllabification-related processes in a sequence of [C, (S)][S]-[high][S] in which a [S]-[high][S] is realized as a vowel sequence rather than a light diphthong. In examples such as /amua/, /barua/, and /kiatu/ that have been given above, a [S]-[high] segment is realized as a vowel and it does not undergo LDF. We should then ask as to what it is that prevents such cases from undergoing LDF.

There are some structural (near minimal) pairs, such as /amua/ (V) 'separate persons fighting' vs. /amwa/ (V) 'suck the breast (said of a baby)', /kiatu/ (N. 7) 'footwear' vs. /myaka/ (N. 4) 'years', etc. As such pairs show, the relevant vowel sequences are found not only at morpheme boundaries but also within morphemes, and, moreover, light diphthongs may also be found within words as well as across morpheme boundaries. Thus the morpheme boundary consideration seems not to be what blocks LDF.

One might well suspect that realization as a vowel sequence is related to the loss of an intervening consonant through historical development. However, as was discussed during our consideration of the variations of noun prefixes in Cl. 7 and 8, I need to deal with this matter synchronically. Then I suppose that whether or not a [S]-[high] segment is realized as a component of a light diphthong is determined in the lexicon.

The theory of Lexical Phonology could elegantly handle this problem also. In KiMvita, I assume that there are at least three levels, which are divided on the basis of phonological considerations. A contrast between a [S]-[high][S] sequence as a light diphthong, and that as a vowel sequence, is found in several cases such as derived nouns of Cl. 1 and 3, N/V/A stems, nouns of Cl. 7 and 8, etc.[28] Some examples are given in (52), where LD and VS indicate light

(52)

		LD		VS	
a.	N/V/A stems	/amwa/ (V)	'suck the breast (said of a baby)'	/amua/ (V)	'separate persons fighting'
b.	Cl. 1 & 3 (derived)	/mw-ivi/ (1)	'thief'	/mu-a^Nd̪iʃi/ (1)	'writer'
		/mw-a^Nzo/ (3)	'beginning'	/mu-a^Nga/ (3)	'light'
c.	Cl. 4	/my-aka/ (4)	'years'	/mi-e^Nbe/ (4)	'mango trees'
d.	Cl. 7 & 8	/tʃ-oo/ (7)	'toilet'	/ki-oo/ (7)	'mirror'
		/vy-oo/ (8)	'toilets'	/vi-oo/ (8)	'mirrors'
e.	Cl. 15	/kw-e^Nda/ (15)	'to go'	/ku-i^Nba/ (15)	'to sing'

b. Cl. 1 & 3 (derived) /mw-ivi/ (1) 'thief'

As can be seen in the examples in (52), [S]-[high][S] sequences in each category exhibit forms either undergoing LDF or not undergoing it. This fact suggests that each category listed above appears to be divided into distinct levels in the lexicon. The classification is made generally according to whether or not items represent an underived status and the non-occurrence of LDF. A contrast within the same noun classes is also apparent.

Firstly, items which are the least affected by phonological derivation, LDF or CCF (Complex Consonant Formation), are recognized as Level 1: they are N/V/A stems, 'Underived' nouns of Cl. 1 and 3 containing prefixes phonetically realized as [ŋ͡mʷ] and nouns of Cl. 7 and 8 with prefixes /tʃ-/ and /vy-/, none of which are involved with LDF. Secondly, all the items which undergo a phonological process, LDF or CCF, are considered to represent Level 2. Finally, the vowel-initial stems which take the prefixes of Cl. 7 and 8 /ki-/ and /vi-/ are classified into Level 3. The same is true with the prefixes of Cl. 1, 3, 4 and 15 which precede certain vowel-initial stems. Hence, vowel-initial stems taking the prefixes /tʃ-/ and /vy-/ are distinguished from those which take the prefixes /ki-/ and /vi-/, and so forth.

I postulate the following three levels in the lexicon for KiMvita, where only the relevant categories are considered. It is apparent that the prefixes of Cl. 1 and 3 /ŋ͡mʷ-/, and the Cl. 7 and 8 prefixes /tʃ-/ and /vy-/ do not undergo any formation rules since they are underlying phonemes.

[28] The prefixes of Cl. 7 and 8 are also affixed to form diminutive forms. Some vowel-initial stems take the prefixes /ki-/ and /vi-/ as in /ki-e^Nbe/ and /vi-e^Nbe/ 'small mango', however, the Cl. 7 and 8 prefixes found in diminutives are excluded from this discussion.

(53)

Lexicon

	morphology	phonology
Level 1:	N/V/A stems	No LDF
	Cl. 1 and 3 (/ŋ͡m^w-/)	"
	Cl. 7 and 8 (/tʃ-/ and /vy-/)	"
Level 2:	N/V/A stems	LDF
	Cl. 1 and 3 (/mw-/)	"
	Cl. 4 (/my-/)	"
	Cl. 15 (/kw-/)	"
	Passive (/Cw-/)	"
	Causative (/ny-/, /fy-/, /vy-/)	CCF
Level 3:	Cl. 1 and 3 (/mu-/)	No LDF
	Cl. 4 (/mi-/)	"
	Cl. 7 and 8 (/ki-/ and /vi-/)	"
	Cl. 15 (/ku-/)	"

The ideas of Lexical Phonology can explain efficiently how the same segmental configurations, a [S]-[high][S] sequence, found in two items are differentiated in terms of levels in the lexicon. The [S]-[high][S] sequences undergoing LDF are found at level 2, where Passive and Causative forms are also found. Prefixes of Cl. 1, 3, 4, 7, 8, and 15 which retain their forms for consonant-initial stems do not undergo LDF, and thus they are seen at Level 1. Those items that appear at Level 1 are considered to exist deeper in the lexicon compared with items found at Levels 2 and 3.

In the post-lexical phonology, a contrast between the occurrence vs. the non-occurrence of LDF in a sequence of [S]-[high][S] is also found. When a pronoun containing a / Cu/ sequence, such as /tu/ 'we, us', /ku/ 'you (sg. obj.)' or /mu/ 'you (pl. sb.), him/her', precedes a vowel-initial morpheme, the vowel /u/ becomes either a component of a light diphthong or that of a vowel sequence.[29] The former is found when a tense marker /a-/ (general present) follows such a pronoun: /sisi-tu-a-soma/ → /sisitwasoma/ 'We are reading'. On the other hand, when a pronoun /tu/, /ku/ or /mu/ precedes a vowel-initial verb, a vowel /u/ in such a pronoun appears as a part of a vowel sequence: /ni-li-ku-a^{N}d̪ikia/ → /[n̩]likua^{N}d̪ikia/ 'I wrote for you'. Regarding a pronoun /mu/, retention or dropping of the vowel /u/ seems to depend on the initial segment of the

[29] See also 3.3.2.2.

following morpheme. When a consonant-initial morpheme follows /mu/, the vowel /u/ drops and /m/ becomes moraic. However, accounting for this aspect is beyond the scope of this thesis, and I leave this for future research.

To sum up, whether or not a [S]-[high][S] sequence undergoes LDF is determined in the lexicon. LDF operates only at Level 2, therefore items found either at Level 1 or at Level 3 do not undergo LDF and retain a configuration of [S]-[high][S] as a vowel sequence.

In the following section, the syllabification of a CGV sequence involving a complex (consonantal) segment, and the internal organization of such a phonetic realization as a secondary articulation type will be investigated.

4. 2. 3. 2 The syllabification of derived complex segments

Forming a complex (consonantal) segment in a sequence of CGV ([C, (S)][S]-[high][S]) takes place when a [C, (S)] segment happens to /n/, /f/, or /v/ in causative forms; the latter two consonants arise as a result of lenition of /p/ or fortition of /w/ respectively. In the following paragraphs, the syllabification-related processes for a CGV sequence, i.e., /nya/, /fya/, or /vya/, involving complex consonant formation (CCF) will be examined.

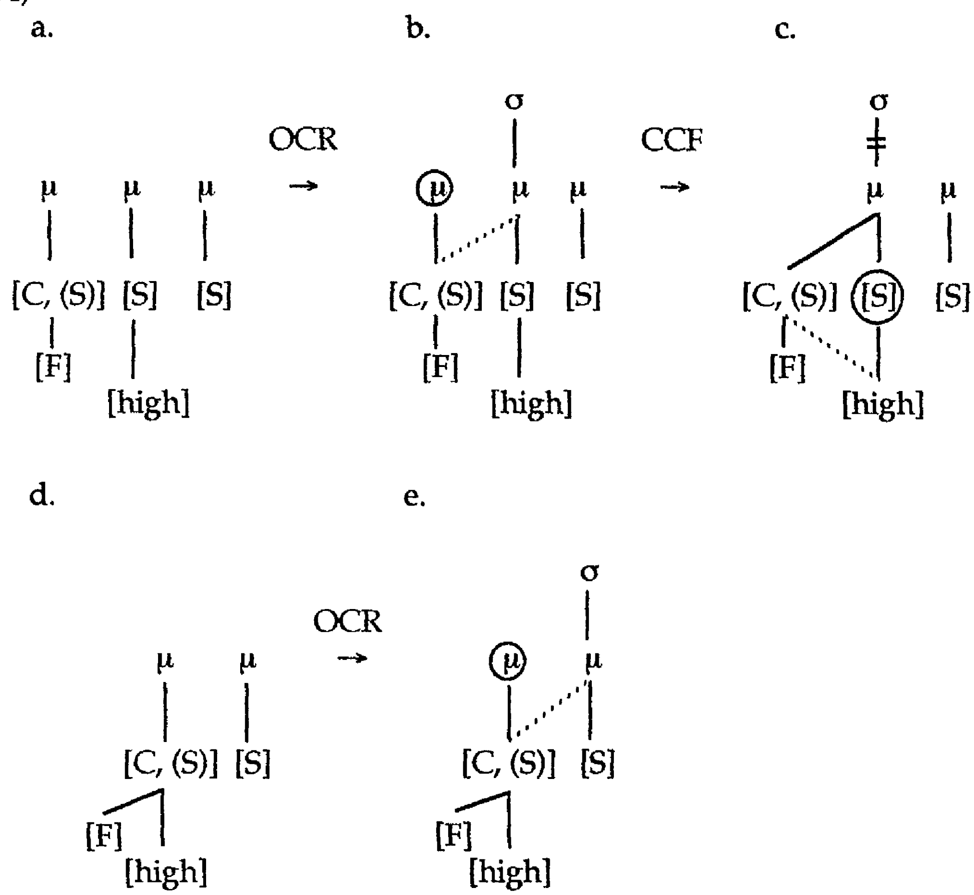
One point should be made clear: the major class feature specification of derived complex segments. In the literature (see Sagey 1986, and Clements 1991a, among others), an underlying complex segment involving a secondary articulation is treated as consonantal. However, discussion about the major class feature specification of a derived complex segment is not clear. Following Clements's (1991a) proposal concerning incorporation of the V-place node under the C-place node, I speculate that incorporation of the root node [S] under the root node [C, (S)] is performed by deletion of the root node [S] and reassociation of the [high] feature to the V-place node to which the preceding [C, (S)] segment is linked through its C-place node via the vocalic node.[30]

Following this, processes of syllabification for a CGV sequence are considered to take place in the following way. The OCR applies to a sequence of C+G first. Then, CCF occurs; the root node [S] is deleted and the [high] feature becomes incorporated under the preceding [C, (S)]. At this point the syllable linked to the deleted [S] is necessarily dissociated from its mora, which is the mora associated with both the [C, (S)] and the [S]-[high] segments.

[30] The [high] feature should be understood as a shorthand form of combination of the place feature and the aperture feature; therefore, in a strict sense, all features associated with the vocalic node are reassociated with the vocalic node which is found in the feature tree of the preceding [C, (S)] segment.

Finally, two morae, one associated with the single [C, (S)][S]-[high] complex segment and the other associated with a following [S] segment, undergo the OCR. In the diagrams, the C-place and the V-place nodes and the vocalic nodes are omitted for ease of exposition. Thus, an incorporation of the [S] segment under the [C, (S)] segment in (54c) should be understood to occur via the V-place node. Moreover, since the [C, (S)] segments are a particular set of consonants (/n/, /f/, and /v/), the [F] associated with the [C, (S)] major class feature in the diagrams specifies one of these segments. Furthermore, the presence of the [F] under the [C, (S)] feature and the grammatical information of 'causative form' are understood to trigger CCF. Finally, it should be mentioned that processes for lenition of /p/ and fortition of /w/ are omitted here. In (54), the features are understood to be associated with the root node via the C-pl. or the V-pl. node.

(54)

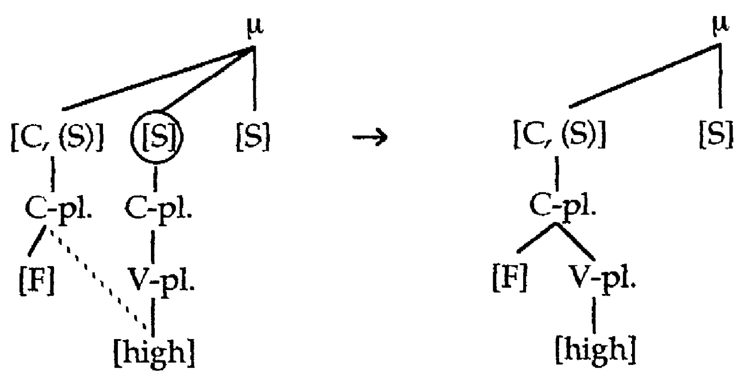


The same observation made for the syllabification depicted in (50) could also be made here. The only difference is that a [S]-[high] segment *may* undergo CCF; i.e., that it is incorporated under a [C, (S)] segment to form a complex segment.

Recall that in some cases the phonetic realization of a CGV sequence is twofold depending on the location of an stressed vowel; the secondary articulation type is heard when a stressed vowel immediately precedes the sequence, while the light diphthong type is perceived elsewhere.[31] If such a phonetic distinction were achieved by the syllabification, stress assignment would have to be assumed to take place before the syllabification processes were complete. In other words, the two distinct pronunciations are realized as a consequence of the stress location factor, and thus the two types of pronunciation would not be distinguished by syllabification in the lexical phonology. Rather, syllabification of the secondary articulation type is seen in the post-lexical phonology. When stress is assigned to a vowel which immediately precedes a sequence of C+G, the root node for a segment G is deleted. Consequently, the features of the V-place node (the vocalic node, to be precise), linked to a segment G, are dissociated and relinked to the V-place node under the C-place node to which the preceding consonant is linked, as shown in (55a). As a result, a C+G sequence syllabified as a light diphthong in the lexical phonology appears as a complex consonant in the post-lexical phonology. On the other hand, when a C+G sequence appears elsewhere other than the particular environment governed by a stressed vowel location, the syllable structure remains that of a light diphthong which it has obtained in the lexical phonology. This is shown in (55b). The diagrams in (55) display essential nodes only.

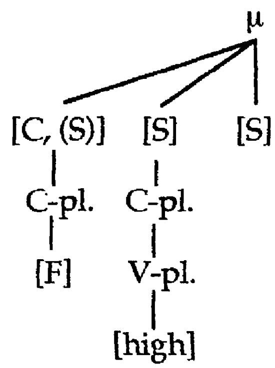
(55)

a. V́CGV → V́[C^{G}]V



31 See also 3.3.2.4.3.

b. VCGV́: V[CV̌V]



The diagram (55a) shows a derivation of the secondary articulation type in the post-lexical phonology from a sequence involving a (phonologically) light diphthong in the lexical phonology. On the other hand, the diagram (55b) shows a light diphthong type phonetically and phonologically.

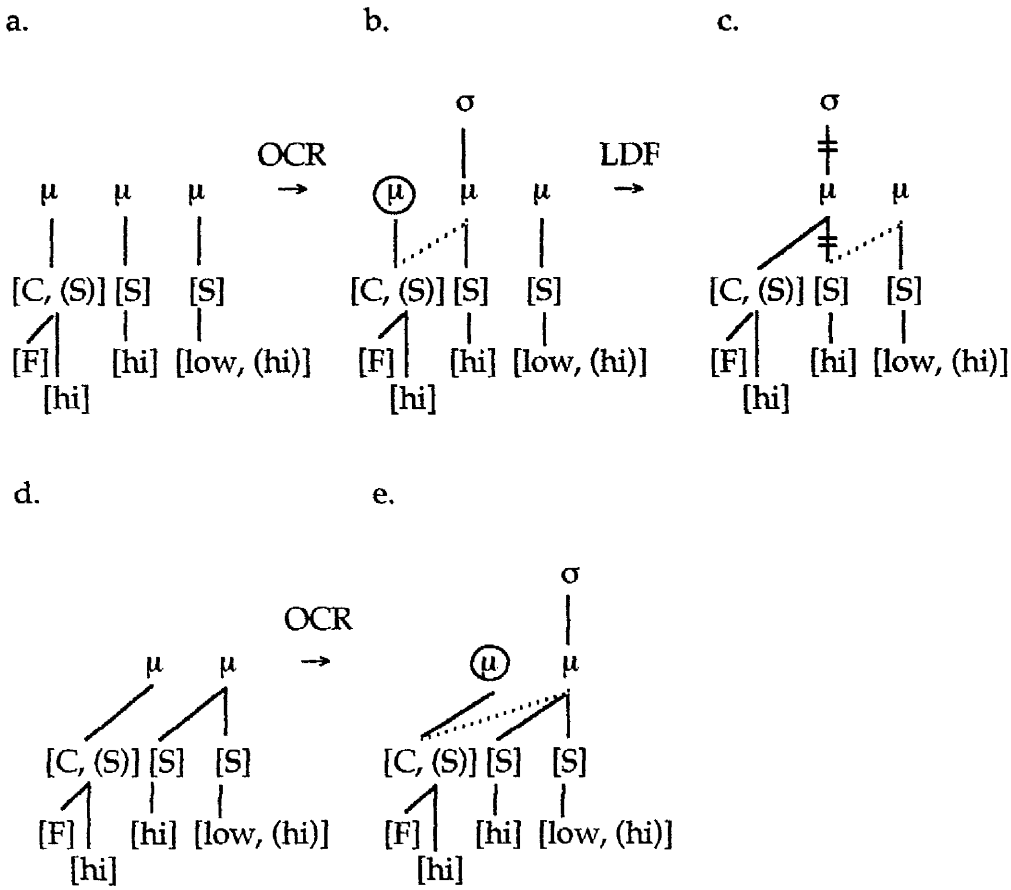
Finally, I discuss the syllabification of a sequence involving two [S]-[high] segments, i.e. /CywV/. In such a sequence C is restricted to /n/, /f/ or /v/. A sequence of /CywV/ is found in verb forms, such as /nywea/ 'shrink', /bofywa/ 'cause to be pressed of a soft surface such as fruit', /t̪ovywa/ 'be dipped', etc.; the sequences /fywa/ and /vywa/ are found only in certain passive forms. As we have discussed in chapter 3, all these three Cy sequences are treated here as phonemes, regardless of whether or not the segment concerned is derived in the morphology.

However, /fywa/ in /bofywa/ is in fact derived from its causative form /bofya/. One might, therefore, consider that the processes of syllabification for /fywa/ would involve CCF operating between /C/and /y/. However, if causative formation is completed before a passive form is derived, a Cy sequence in the input could be treated as a complex segment in a /CywV/ sequence. Hence, /Cy/ here is not regarded as a sequence but as a single segment, which is specified as [C, (S)] by its major class features. Regarding V, it is either a low or a mid vowel, which is specified as either [low] or [low, high] respectively.[32] Consequently, a sequence of [C, (S)][S]-[high][S]-[low]/-[low, high], i.e., /CywV/, would undergo the same syllabification-related processes as the sequence CGV which involves LDF. Thus, the OCR operates between a complex segment and a [S]-[high] segment, which is followed by LDF taking place with a [S]-[high] segment and a [S]-[low]/-[low, high] segment. Finally, a [C, (S)] segment and a light diphthong [S]-[high][S]-[low]/-[low, high] undergo

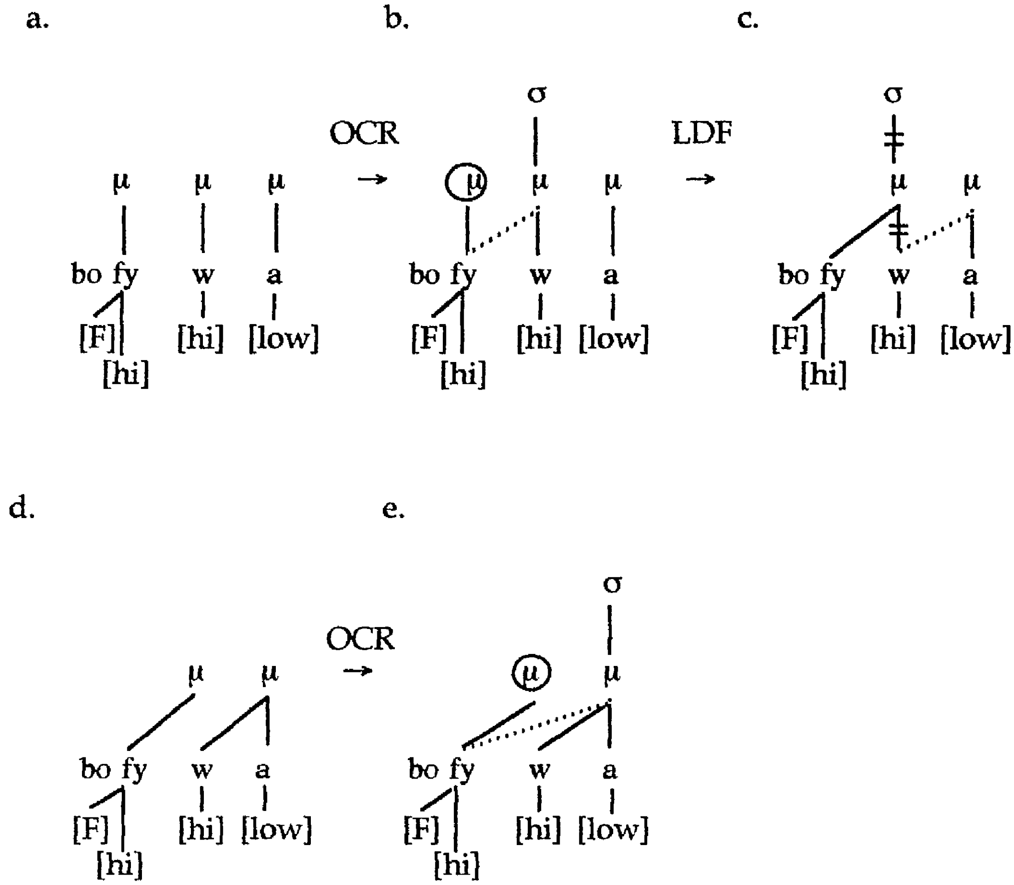
[32] The use of features [low] and [high] is simply for ease of exposition (see fn 20).

the OCR to form a sequence of C^{G}GV. The procedure for the syllabification of C^{G}GV is shown in (56), and the word /bofywa/ 'cause to be pressed of a soft surface such as fruit' is exemplified in (57). Note that the features are understood to be associated with a root node via the C-pl. or the V-pl. node, and the [F] specifies a consonant either /h/, /f/ or /v/.

(56)



(57) /bofywa/



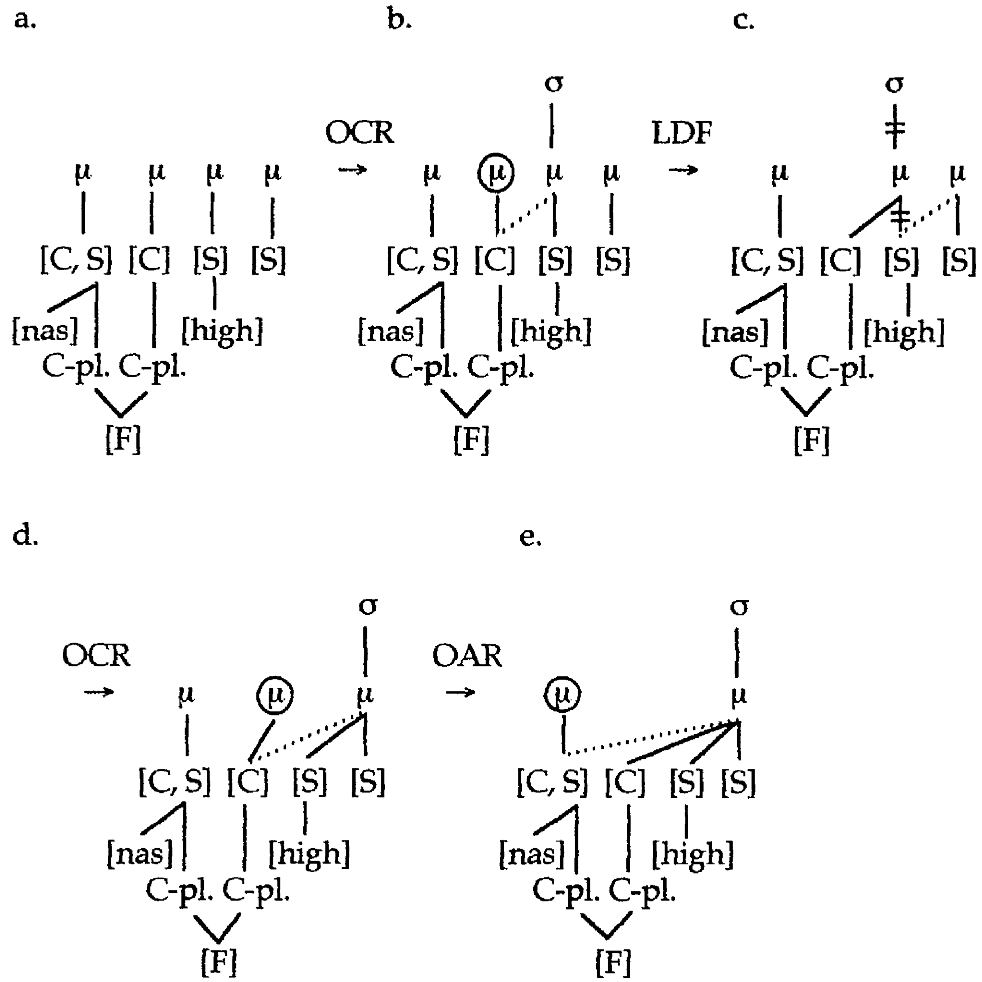
4. 2. 3. 3 The syllabification of N+C+G+V sequences

The last concern of the syllabification-related processes is a sequence of NCGV, where a N+C is a prenasalized obstruent. One might raise a question as to whether or not such a sequence involves two types of composite segment, a complex consonant along with a prenasalized obstruent.

As has been discussed concerning possible C^y phonemes in 3.3.2.5.4, the newly acquired /f^y/ and /v^y/ are unit phonemes underlyingly in addition to /ɲ/ which is recognized as already existing in the inventory. Hence if there is a word containing one of these phonemes in a string of NCGV, there might be a possibility that we find a prenasalized obstruent with the secondary articulation. However, KiMvita does not contain a prenasalized voiceless fricative *$/^N$f/ or a prenasalized palatal nasal *$/^N$ɲ/, though a prenasalized voiced fricative might be found. Nevertheless, such cases seem not be attested in KiMvita. Thus, a sequence of NCGV may not be regarded as containing two types of composite consonant; in other words, G+V in the NCGV forms a light diphthong.

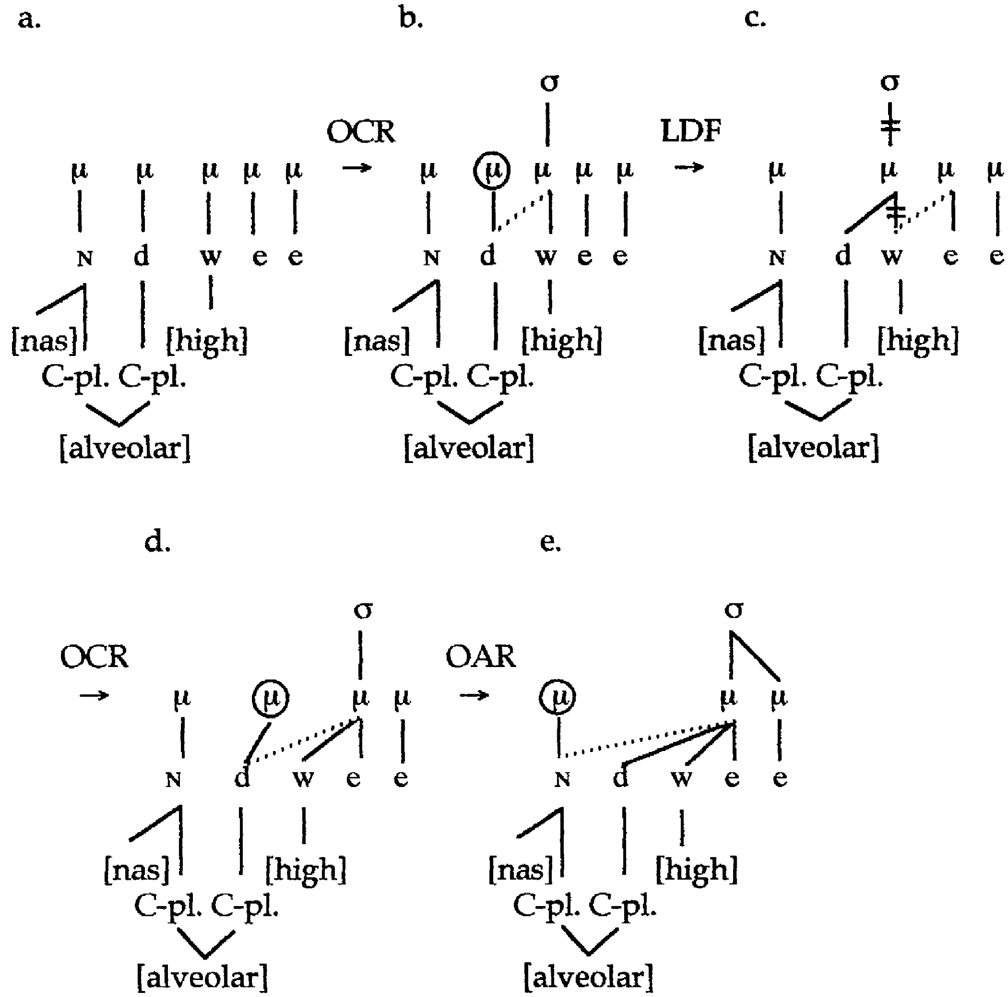
The processes begin with the OCR, which takes place between a [C] segment and a [S]-[high] segment in accordance with the assumptions of (49) and the revised OCR. This is followed by LDF, and then a second occurrence of the OCR which links the [C] segment and the light diphthong that follows it. Finally, the nasal component of the prenasalized obstruent undergoes the OAR. The process is diagrammed in (58), and the first syllable of the word /ᴺdwee/ (N. 9/10) 'sickness' is exemplified in (59), where the [alveolar] feature is employed rather than the [coronal] feature (see 4.1.1.3.1.4).[33]

(58)



[33] In Johnson (1939), this word is spelled as *ndwele*, and /uele/ is also found in KiMvita.

(59)



4. 2. 3. 4 Summary of syllabification involving C+G sequences

To sum up, under the assumptions of (49) and the revised OCR, in the syllabification of CGV sequences, the OCR is the first rule to apply and left-to-right syllabification takes place. Two types of processes may occur, one for a sequence containing a light diphthong, the other for a derived complex consonant, C^G. After the first application of the OCR takes place, either Light Diphthong Formation (LDF) or Complex Consonant Formation (CCF) occurs. The [S]-[high] segment may dissociate from its mora and link to the following mora associated with a vowel to form a light diphthong, i.e., LDF, while the [high] feature may dissociate from the root node [S] and incorporate into the preceding [C, (S)] node via its V-place node to form a complex segment, i.e., CCF, in which a consonant is restricted to /n/, /f/, or /v/. However, some [C, (S)][S]-[high][S] sequences do not undergo LDF but remain a vowel sequence.

Such a distinction is assumed to be determined in the lexicon. Moreover, the location of the stressed vowel determines the two types of phonetic realization of C+G sequence, and thus they have distinct syllable structures in the post-lexical phonology; when a stressed vowel immediately precedes a C+G sequence, the sequence undergoes CCF and is heard as a secondary articulation type pronunciation; on the other hand, when there is no stressed vowel immediately preceding a C+G sequence, the sequence is phonetically realized as a light diphthong, and no further structural change is seen. In addition, in a sequence appearing to contain two high vocoids, /CywV/, the /Cy/ is regarded as a single segment underlyingly, and consequently, the process of syllabification is the same as one involving LDF. Finally, a sequence of N+C+G+V requires LDF to take place between a G and a V, and the OAR occurs together along with the OCR.

Chapter 5
Moraic nasals in Japanese

5. 0 Introduction

A good many aspects of Japanese phonology have been discussed within different frameworks in the literature to date. Among these, however, the treatment of trimoraic (super-heavy) syllables has not been discussed very extensively. There is a consensus concerning trimoraic syllables on the part of many phonologists to the effect that the inventory of Japanese syllable types does contain a trimoraic syllable type, but that it should be treated as a marked case. Normally this kind of syllable results from morphological derivations involving affixation (e.g., a past tense morpheme *-ta*)[1], compounding, or loanwords.[2] It sometimes involves the moraic part of a geminate consonant preceded by a vowel sequence or a sequence of a short vowel followed by a moraic nasal; i.e., CV1V2Ç (where $V1 = V2$ or $V1 \neq V2$) or CVNÇ.[3] In view of its concern with moraic nasals, this study primarily considers the third type of sequence, i.e., CVNÇ. However, other types of sequences are also dealt with in the course of discussion, since V2 and N share the same property, which is that both hold an association with the second mora in a syllable. Section 5.1 will consider moraic nasals in ordinary cases and in special cases. This is followed by a discussion of accent location and of the appropriate accent assignment rule in Japanese. This is vital in order to appreciate that a moraic nasal may not bear an accent. Here, the segments associated with the second mora other than the nasals, i.e., V2 of V1V2, and the first component of a geminate consonant will also be considered. Then, in section 5.3, I will deal with the syllabification of moraic nasals. It will be seen that there cannot be any controversy over the syllabification of moraic nasals found in a CVN sequence, discussed in section 5.3.2. On the other hand, it will be seen that the syllabification of moraic nasals in words containing a CVNÇ sequence is not so straightforward. Two different

1 In certain past tense verb forms, a past tense morpheme appears to involve a geminate consonant; for example, *tor-ta* 'take-past' → *totta* (see 5.3.3.3).

2 As noted in 1.2.3.2, two identical consonants represent a geminate consonant and the left-most segment is understood to be moraic.

3 Ç refers to a moraic obstruent (see 2.1.3).

types of syllabification discussed in the literature will be presented first, and then I shall revise them.

5. 1 Two Types of Moraic Nasal: Ordinary vs. Special Cases

Moraic nasals are always preceded by a vowel regardless of whether they appear in any syllable types. They may appear word-medially or word-finally, but never word-initially since they need a preceding vowel. Symbolized as N, they are realized as homorganic to a following consonant when they occur in a word-internal position, while in a word-final position, their phonetic realization is as a uvular nasal, [ɴ̩].

(1) Moraic nasals in ordinary cases

a.	aN → a[ɴ̩]	'bean paste'
b.	paN → pa[ɴ̩]	'bread' (loanword)
c.	aN + paN → a[m̩]pa[ɴ̩]	'bean-paste bun'
d.	hoNdana → ho[n̩]dana	'bookshelf'

As can be seen in (1c), the moraic nasal, N, is realized as homorganic to the following consonant *p* after compounding since it is no longer in a word-final position. The moraic nasals in (1) are considered ordinary cases because they may not bear an accent, since this has always to be associated with the first mora of a syllable; *a*N, pa*N, aN.pa*N,*[4] *ho*N.da.na* (* and . indicate the accent and a syllable boundary respectively).[5]

However, there is a special case in which a moraic nasal does bear an accent. Examples are given in (2).

(2) Moraic nasals in special cases

a.	ro*[n̩]do[ɴ̩] + kko	→	ro[n̩]do[ŋ̩*]kko	'Londoner'
b.	o-ka*asa[ɴ̩] + kko	→	okaasa[ŋ̩*]kko	'a person who is very close to his/her mother'

[4] The word *aNpaN* seems not to be treated as a lexically created compound but as an underived word. If it were a compound, the accent would fall on the first *a*, since the antepenultimate mora is a moraic nasal, which induces the accent shift discussed in 1.2.3.2. Alternatively the word *aNpaN* is realized unaccented (see Nihon Hoso Kyokai 1998).

[5] Not all words/morphemes contain accent (see 5.2).

When a morpheme *-kko* 'child (lit.)' is affixed to a word containing a final CVN sequence, the moraic nasal, which is normally not permitted to be an accent bearer, comes to bear the accent (cf. Shirota 1993: 101, Kubozono 1995: 243).[6]

In sum, there are two types of moraic nasal in Japanese; one that may not bear an accent, and one that may bear an accent. The latter case should be treated as a special case, and perhaps the syllabification of these two different moraic nasals should be seen as different, if the Accent Bearer Constraint is respected (see 5.2.3).

5. 2 Accent

Accentual languages are roughly divided into two groups; stress accent languages and pitch accent languages (cf. Beckman's (1986) term 'stress accent' for the former vs. 'non-stress accent' for the latter). Whatever be the terms, it is generally agreed that while pitch is the only general phonetic cue for 'pitch accent', 'stress accent' uses a combination of pitch and other phonetic phenomena such as duration, loudness, etc. as its cue. Japanese is a well-known case of a pitch accent language, while KiMvita (Swahili) and English are classified as stress accent languages.

5. 2. 1 Tonal Assignment

As we have already seen in the accent rules discussed in 1.2.3.2, the eventual pitch pattern of Japanese words containing up to four morae is determined in the lexicon. I shall repeat here the example (8) from 1.2.3.2 and the generalized version of the tonal association rule given there.

Before the tonal association rule is described however, the tonal melody in Japanese should be mentioned. As has been seen in 1.2.3.2, the distinct tonal melodies are assigned to the first two morae: L(ow)H(igh) or HL. Only when the first mora is accented is HL found. Goldsmith (1974) proposes L$\overset{*}{\text{H}}$L (with an accent mark), while Haraguchi (1977) claims HL (without an accent mark). Haraguchi's tonal melody appears to be LHL after his Initial Lowering rule

[6] This exceptional behaviour also occurs in a V_2 of CV_1V_2 ($V_1=V_2$, $V_1 \neq V_2$) sequence followed by a morpheme *-kko* such as *tookyookko* 'a person native to Tokyo' and *geNdaikko* 'a child of today' (see Yoshida 1991, Kubozono 1995: 243).

takes place. As a general view, LHL (without an accent mark) could be regarded as the tonal melody for Japanese

The tonal association rule as described by most linguists is briefly as follows: (i) the H tone is associated with an accented Tone Bearing Unit (hereafter TBU), which is equivalent to the mora under the current theory, and it spreads leftwards; (ii) the L tone is associated with TBU's following the accented TBU; (iii) the first TBU is also always associated with the L tone unless it bears accent. It follows, therefore, that the first TBU and the second TBU never link to the same tone, i.e., word-initial tone sequences are either LH or HL; (iv) if there is no accented TBU, the surface tonal pattern will be LHn-1 (where n is the number of TBU's a word consists of).

(3)

a. i*noti (HLL)	b. koko*ro (LHL)	c. otoko* (LHH)	d. nezumi (LHH)
'life'	'mind'	'man'	'rat/mouse'

(Kubozono 1995: 27)

In the examples in (3a, b), pitch drops after an accented segment; i.e., on *noti* of *inoti* and on *ro* of *kokoro*. The words in (3c, d) exhibit the same pitch pattern, (LHH), although *otoko* is accented whereas *nezumi* is unaccented. However, the difference between them shows up when an item such as the subject particle *-ga* follows. Then it is realized with a low tone in an accented word, *otoko-ga* (LHHL), and with a high tone in an unaccented word, *nezumi-ga* (LHHH). This sudden drop in pitch is said to be the primary acoustic cue for the location of accent in Japanese, and this view is widely accepted in the literature (see McCawley 1968, Poser 1984, and Kubozono 1987, 1995, among others).

On the basis of this acoustic (pitch-based) characterization of Japanese accent, Japanese accent is characterized as 'pitch accent', and Japanese is classified as a 'pitch accent language'. Although all phonologists agree that the location of accent is signalled by the pitch drop, terms vary among them, for example 'abstract accent' (Haraguchi 1977), 'accent nucleus' (Hattori 1980, Kubozono 1987, 1995), etc. However, in this thesis, the simple term 'accent' is used. Regarding notation for accent in this thesis, as seen in the examples above, an asterisk, *, is employed. Accurately represented the asterisk should be associated by an association line with an accent bearer, however, for ease of representation, it is frequently just placed above a sonorant segment; as in *i* of *inoti* in (3a). This is always to be understood as an abbreviated form so that

$\overset{*}{i}$ is a conventional simplification of

```
      *
      |
&lt;accent bearer&gt;
      |
      i.
```

It is widely accepted by phonologists that the accent bearer is the syllable in Japanese. Yoshiba (1983), however, holds that the mora is the accent bearer. In the following section, I shall investigate which phonological constituent it is that is the accent bearer.

5. 2. 2 The Accent Bearer

With respect to the accent bearer, two views can be found in the literature. Both views agree on the point that accent assignment is measured in terms of the mora; however, they differ concerning what is the actual accent bearer. On the one hand, most phonologists (McCawley 1968, 1977, and Kubozono 1987, 1995 among others) consider the syllable to be the accent bearer, while Yoshiba (1983) makes the claim that the accent is borne by the mora, and Poser (1990) also holds the view that metrical phenomena are accounted for by the morae. Yoshiba's position seems to be stronger than the other researchers's claims, and suggests 'the syllable' could be replaced by 'the mora' in their accounts of the accent bearer.

Two pieces of evidence provided by advocates of the claim that the accent bearer is the syllable are: (i) that the syllable is the only one possible place for the accent in a heavy syllable; and (ii) that the 'Pre-*no* Deaccenting Rule' (see below) is best generalized with reference to the syllable. These two pieces of evidence might convince us that the syllable is the accent bearer. Nonetheless, the mora seems also to account for these cases in a clear manner.

Firstly, the evidence cited in (i), which is related to accent shift (see 1.2.3.2 and below), is discussed. Accent shift occurs when the accent is assigned to the second mora of a bimoraic syllable; it moves to the first mora. Schematically this is:

```
   σ           σ
  / \    →    / \
     *        *
  μ1  μ2      μ1 μ2.
```

Kubozono (1987, 1995) explains this phenomenon as the accent shifting within the same syllable, so that it could be said that even if accent shift occurs, the accent bearer itself never changes. If the syllable is the accent bearer, however, then accent shift ought to move it to another syllable. Kubozono's recognition of this point is a very cogent argument for the need for the syllable in Japanese phonology (cf. 5.3.1). He continues that the actual focus for the accent in terms of phonetic realization is the mora, and thus, although a bimoraic syllable bears the accent regardless of the operation of accent shift, the sudden drop in pitch is always perceived after the first mora. In his account, Kubozono has to differentiate the phonological accent bearer from the phonetic accent bearer. This is because if it were the case that the accent bearer were the syllable, the pitch fall would appear after the second mora of the accented syllable, which is never attested. On the other hand, if the accent bearer is the mora, there is no need to differentiate the accent bearer from the tone bearer. However, the existence of syllable nodes as reference points in Japanese phonotactics is still essential.

The next piece of evidence concerns the Pre-*no* Deaccenting phenomenon. A rule for this phenomenon says that if there is an accent on the final syllable of a noun, deaccenting occurs when the genitive particle *-no* is attached to it (see McCawley 1968, Haraguchi 1977, Kubozono 1987). Examples are given in (4).

(4)

a.	kaw$\overset{*}{a}$ + no	→	kawano (LHH)	'river - genitive'
	atam$\overset{*}{a}$ + no	→	atamano (LHHH)	'head - genitive'
b.	nih$\overset{*}{o}$N+ no	→	nihoNno (LHHH)	'Japan - genitive'
	kin$\overset{*}{o}$o + no	→	kinoono (LHHH)	'yesterday - genitive'
	otot$\overset{*}{o}$i + no	→	ototoino (LHHHH)	'the day before yesterday-genitive'
c.	kok$\overset{*}{o}$ro + no	→	kok$\overset{*}{o}$rono (LHLL)	'mind - genitive'
	$\overset{*}{i}$noti + no	→	$\overset{*}{i}$notino (HLLL)	'life - genitive'

In (4a), the genitive particle *-no* is preceded by an accented monomoraic syllable, *w*$\overset{*}{a}$ or *m*$\overset{*}{a}$, while, in (4b), an accented bimoraic syllable, *h*$\overset{*}{o}$*N* or *n*$\overset{*}{o}$*o*, precedes the genitive particle *-no*, and these behave like those in (4a). The examples in (4c) demonstrate that when the accent is located other than on the last syllable, deaccenting does not take place. From these facts, the syllable can be used for making a generalization such as; the Pre-*no* Deaccenting Rule takes place if and only if the final syllable is accented. Kubozono, among others, therefore, claims that the syllable is the accent bearer.

However, Poser (1984: 175) provides counter examples to (4b), given in (5); I have added the last seven words according to the pronunciation of a native (Standard) Japanese speaker.

(5)

satoo + no	→	satoono (LHLL)	'sugar - genitive'
seNsee + no	→	seNseeno (LHHLL)	'teacher - genitive'
koohii + no	→	koohii (LHHLL)	'coffee- genitive'
sikeN + no	→	sikeNno (LHLL)	'exam - genitive'
ehoN + no	→	ehoNno (LHLL)	'picture book - genitive'
hukoo + no	→	hukoono (LHLL)	'misfortune - genitive'
zizii + no	→	zizii no (LHLL)	'old man - genitive'
ryuukyuu + no	→	ryuukyuuno (LHHLL)	'Ryukyu - genitive'
tyooseN + no	→	tyooseNno (LHHLL)	'Korea - genitive'
taiwaN + no	→	taiwaNno (LHHLL)	'Taiwan - genitive'
saNsuu + no	→	saNsuuno (LHHLL)	'arithmetic - genitive'
yooteN + no	→	yooteNno (LHHLL)	'the point - genitive'
kokuoo + no	→	kokuoono (LHHLL)	'king - genitive'
haNbuN + no	→	haNbuNno (LHHLL)	'a half - genitive'
sihoo + no	→	sihoono (LHLL)	'all sides -genitive'
batteN + no	→	batteNno (LHHLL)	'bad mark - genitive'
keesuu + no	→	keesuuno (LHHLL)	'calculation - genitive'

As can be seen, the examples in (5) are not affected by the Pre-*no* Deaccenting Rule.[7] Although both examples (4b) and (5) show that the final syllable is the accent bearer, assuming that the accent is borne by the syllable, the deaccenting rule does not apply in the examples of (5). In other words, the correct generalization for this phenomenon cannot be made if the syllable is the accent bearer. And even if the accent bearer were some other phonological constituent, this phenomenon could not be explained in a uniform fashion. A possible approach to this would be that one or other of the sets is treated as having exceptions. In such a case, it is plausible to assume the examples in (4b) are the exceptions in terms of the number of examples.[8] In addition, accented-monomoraic (one-syllable) nouns such as *ha* 'tooth' and numerals, for example, *iti* 'one', *roku* 'six', *hati* 'eight', etc. would also have to be treated as exceptions

[7] More words which do not undergo the Pre-*no* Deaccenting Rule are found in Vance (1987: 82).

[8] According to Nihongo Hatsuon Akusento Jiten (Nihon Hoso Kyokai 1998), words *ryuukyuu* 'Ryukyu', *tyooseN* 'Korea', *taiwaN*, 'Taiwan', and *nippoN* 'Japan' also undergo the Pre-*no* Deaccenting Rule. However, among native (Standard) Japanese speakers, these words except for *nippoN* seem to be marginal. My informant, in fact, exhibits an accented pronunciation as Poser states. Even if those words are added to (4b), the number of words found in (4b) are still smaller than those in (5) in terms of exceptions.

in either a mora-based or a syllable-based analysis, since they do not undergo the rule.

If the examples in (5) do not undergo the deaccenting rule, then the generalizations for the Pre-*no* Deaccenting Rule could be presented using the mora; i.e., the deaccenting rule may apply if the final mora of a noun is accented, when the genitive particle *-no* is attached to it. This rule, obviously, cannot handle the examples shown in (4b). However, the reference to the mora for this phenomenon reduces the number of exceptions, since accented bimoraic-one syllable words given as in (6) would be accounted for in terms of the mora-based rule, however they would be regarded as exceptions if the generalization were made with reference to the syllable.

(6)

k$\overset{*}{o}$i + no	→	k$\overset{*}{o}$ino (HLL)	'love - genitive'
k$\overset{*}{a}$i + no	→	k$\overset{*}{a}$ino (HLL)	'seashell - genitive'
h$\overset{*}{o}$N + no	→	h$\overset{*}{o}$Nno (HLL)	'book - genitive'
k$\overset{*}{o}$o + no	→	k$\overset{*}{o}$ono (HLL)	'back of hand/top of foot - genitive'

Thus, to say that the mora is the accent bearer is preferable in terms of accounting for the Pre-*no* Deaccenting phenomenon.

To conclude, it appears that the mora may be the preferable prosodic unit for explaining these cases. Concerning the evidence presented in (i) regarding accent shift operating in a bimoraic syllable, postulating that the accent bearer is the mora rather than the syllable means that we do not need to explain the pitch fall which occurs between the first mora and the second mora of an accented bimoraic syllable. In fact, a sudden drop in pitch is never realized following the second mora, where the pitch fall would be naturally expected if the syllable were indeed the accent bearer. Therefore, I hold to the claim that the accent assignment is counted by, and borne by, the mora, though with the necessary apparatus of syllable nodes. As has been discussed in 2.1.1.2, the distribution of moraic nasals is best analyzed making reference to syllable nodes (see also 5.3.1, and Poser 1990). Hence, the asterisk is associated with the mora which, in turn, is associated with a root node which exhibits the major class feature as well as with the syllable node; σ

| *

| /

μ

|

[S]. However, the association just depicted of the syllable node, the asterisk, the mora, and the root node does not, according to the theory employed in this thesis, show a syllable structure.

5. 2. 3 Accent Assignment for Polymoraic Words

Accent assignment for polymoraic words, which include simple nouns, compounds, and loanwords, will be discussed. The accent assignment rule and the accent shift rule are essential to a discussion of the syllabification of moraic nasals in Japanese, and therefore, I shall treat them in this section although it will overlap to some extent with the discussion in 1.2.3.2. Note that the term 'polymoraic' refers to four or more morae.

The accent is normally not assigned to simple polymoraic nouns, compounds, and loanwords in the lexicon. In the literature, accent assignment rules are generally divided into two categories: the accent assignment rule for loanwords, and that for compounds. Before further discussion, usage of the term 'compound' should be defined here. In the literature, the term 'compound' is employed in a rather broad sense (see McCawley 1968, Higurashi 1983, Kubozono 1987, 1995, Poser 1990, Haraguchi 1991, Yoshida 1995). For example, Kubozono (1995: 60) states that the Compound Accent Rule is applicable not only to compounds but also to derivatives. Yoshida (1995: 57) also states that it is necessary to recognize more than one type of morphological structure for the concatenated nouns denoted by the term 'compound'. Following them, I use the term 'compound' in this thesis to include both compounds and derivatives.

Regarding the accent assignment rule for loanwords and polymoraic nouns, the following rule is widely accepted; assign the accent to the antepenultimate mora: for example, *kuris*$\overset{*}{u}$*masu* 'Christmas' and *kirig*$\overset{*}{i}$*risu* 'grasshopper' respectively.

On the other hand, the rule for compounds is not as simple as that for loanwords and polymoraic nouns. The accent assignment rules for any kind of internally concatenated word depend heavily on the characteristics of the second (rightmost) morpheme. The length of the second morpheme, the accent location or its unaccented state, its grammatical category, and so on, are all important factors to be considered.[9] Since this thesis does not discuss the accent assignment rules for compounds in detail, I mention the rule which applies only when the second morpheme contains two or more morae.[10] Based on previous work on the compound accent rules posited by many scholars (see McCawley 1968, 1977, Higurashi 1983, Kubozono 1987, 1995, Yoshida 1995), I shall cite a rule which covers all the categories we have discussed so far. The formulation given is that of Haraguchi (1991: 12).[11]

(7) Accent Assignment Rule

Assign the accent to the antepenultimate mora of long nouns and noun equivalents of the [+accented] class.

Haraguchi's term "noun equivalent" includes compounds and loanwords, and "long nouns" are what are here termed polymoraic nouns. Examples in (8) are all captured by the rule in (7).

(8)

a. compounds

ha⃰ru	+	kaze⃰	→	haru⃰kaze (LHLL)
'spring'		'wind'		'spring breeze'
ha⃰ru	+	kasumi	→	haruga⃰sumi (LHHLL)[12]
'spring'		'haze'		'spring haze'

b. polymoraic nouns

hototo⃰gisu (LHHLL)
'the little cuckoo'

kirigi⃰risu (LHHLL)
'grasshopper'

c. loanword

kurisu⃰masu (LHHLL)
'Christmas'

---

[9] See McCawley (1968), Higurashi (1983), Kubozono (1987, 1995), Yoshida (1995).

[10] Concerning two-mora long morphemes, there are some exceptions. When *mado* 'window', *damu* 'dam', or *hari* 'needle', appears to be the second morpheme, they do not follow the rule in (7), but the penultimate segment bears accent: e.g., *koosi* 'lattice' + *ma⃰do* 'window' → *koosima⃰do* (LHHHL) 'latticed window'.

[11] It is still necessary to have another accent rule for a second morpheme which comprises only one mora. See Kubozono (1995) for detail.

[12] *Rendaku*, 'sequential voicing' in Martin's (1952:48) translation, has occurred in this compound: in general, the initial voiceless obstruent of the second morpheme is replaced by a voiced counterpart only when the second morpheme does not contain any other voiced obstruent (see Itô and Mester 1986, Vance 1987).

However, the antepenultimate mora is not always a desirable accent bearer; for example, there is a possibility that an accent might be assigned to the second mora of a syllable, i.e., to a nasal, or to the moraic component of a geminate consonant, or to the second component of a (bisegmental) long vowel or of a vowel sequence. In the literature, it is claimed that the second mora of a bimoraic syllable, regardless of the segment type it is associated with, may not bear an accent (cf. McCawley 1968, Kubozono 1995: 20). Hence, the Accent Shift Rule, as was discussed in i.2.3.2, is required. The rule (11) in chapter 1 is repeated in (9). Examples are given in (10), where . indicates a syllable boundary.

(9) If the accented mora is the second mora of a syllable, accent is shifted to its left.

(10)

Uncompounded component words		Accent assignment rule		Accent shift
a. d$\overset{*}{a}$i + zeN.tee 'big' 'premise'	→	dai.ze$\overset{*}{N}$.tee 'major premise'	→	dai.z$\overset{*}{e}$N.tee
b. $\overset{*}{o}$N.ga.ku + k$\overset{*}{a}$i 'music' 'gathering'	→	oN.ga$\overset{*}{k}$.kai 'concert'	→	oN.g$\overset{*}{a}$k.kai
c. d$\overset{*}{a}$i + koo.doo 'large' 'hall'	→	dai.ko$\overset{*}{o}$.doo 'large hall'	→	dai.k$\overset{*}{o}$o.doo
d. s$\overset{*}{i}$N + kai.ha.tu 'new' 'development'	→	siN.ka$\overset{*}{i}$.ha.tu 'new development'	→	siN.k$\overset{*}{a}$i.ha.tu
Loanwords				
e. syaN.puu 'shampoo'	→	sya$\overset{*}{N}$.puu	→	sy$\overset{*}{a}$N.puu
f. de.rak.ku.su 'deluxe'	→	de.ra$\overset{*}{k}$.ku.su	→	de.r$\overset{*}{a}$k.ku.su
g. tii.taa 'cheetah'	→	ti$\overset{*}{i}$.taa	→	t$\overset{*}{i}$i.taa
h. de.zai.naa 'designer'	→	de.za$\overset{*}{i}$.naa	→	de.z$\overset{*}{a}$i.naa

(Examples in (10e-g) are cited from Kubozono, 1995: 20)

The examples in (10) illustrate that if a mora which comes to bear accent as allotted by the rules stated in (7) is the second mora of a syllable (e.g., the moraic nasal as in (10a, e), a component of a geminate consonant as in (10b, f), a component of a long vowel as in (10c, g), and a component of a vowel sequence as in (10d, h)), then the accent is shifted one mora to its left.

The statement in (9) implies that the status of the second mora of a syllable is different from the first mora. In the traditional approach (see Shibata 1980, among others), the first mora of a syllable is called '*jirituhaku* (independent mora)' while the second mora of a syllable is called a '*huzokuhaku* (attached mora) or *tokushuhaku* (special mora)'. Kubozono (1989) names these two different types of mora the 'syllabic mora' and the 'non-syllabic mora' in the sense of being capable or incapable of constructing a syllable. This view is supported by Nagano-Madsen (1992). The interpretation of the two names seems to correlate with the view of the accent bearer held by McCawley (1968, 1977). However, I shall call them the 'independent mora' and the 'dependent mora' on account of their roles in constructing a syllable, there being no correlation between the syllable and the accent bearer. The former is capable of constituting a syllable under the condition that there is a preceding onset consonant (at least a surface glottal stop). On the other hand the latter, the dependent mora, needs an independent mora in order to be syllabified. This is related to the necessity of providing syllable structures in Japanese as dealt with in the following section.

To sum up, one important constraint concerning accent assignment is that the second mora of a bimoraic syllable may not be an accent bearer.[13] Hence if such a case is derived, the accent shift rule of (9) takes place.

5. 3 The Syllabification of Moraic Nasals

The fact that a moraic nasal in Japanese is always preceded by a vowel and that it is syllabified as the second moraic segment of a bimoraic syllable is undeniable. Therefore, a moraic nasal is always found in a syllable structure such as [CVN]σ; however, syllable structures such as *[CN]σ, *[NCV]σ, or *[CNV]σ are never found. In the following subsections, I shall first discuss the necessity of syllable structures in Japanese phonology, and then consider the syllabification of moraic nasals in ordinary cases. This is followed by considering the syllabification of certain special cases.

[13] Such an accent bearer constraint is also found in Rendille, one of the East Cushitic languages, hence accent shift occurs this language; for example, *ɪ̣.ti → *ɪɪ̣.ti: ɪ́ɪ̣.tì 'bead' (see Pillinger 1989).

5. 3. 1 Are Syllable Structures really Necessary in Japanese?

In the discussion so far, the existence of syllables in Japanese phonology has been taken for granted. I now need to investigate why syllable structures are necessary phonological constituents in the language. The distribution of moraic nasals may reveal the necessity of a syllable node, as was discussed in 2.1.1.2.

Recall that moraic nasals appear either in a word-final position, or in a word-internal position, and never appear in a word-initial position in Japanese. They are always preceded by a vowel. In the case of moraic nasals appearing word-internally, they can be followed by any onset consonant or any vowel; schematically, CVN#, CVNCV, CVNV, but *#NCV. Thus, while words such as *kaN* 'tin/can', *kaNji* 'Chinese character', and *kaNi* 'ease' are attested, nonce words such as **Nka*, **Nkai*, and **Nkaji* would not be. However, a sequence of CVNV, for example, *kaNi* raises a question as to whether a N is realized as an onset to the following vowel. This will be dealt with in 5.3.2.3. When a moraic nasal is followed by a vowel, there is generally a morpheme boundary, since almost no vowel-initial syllable is to be found morpheme internally (Vance 1987: 16). Therefore, a sequence of CVNV could be interpreted as CVN[RN]V: a root node could be considered before a vowel-initial morpheme when it appears in a Sino-Japanese compound (see 5.3.2.2), and a N is never realized as an onset to the following vowel.

The generalization regarding moraic nasals stated above can be made in a simple and clear way if I employ a phonological entity smaller than the word, namely the syllable. The N's in CVNCV and CVNV sequences may be syllabified as CVN.CV and CVN.V, but may not be syllabified either as *CV.NCV or as *CV.NV. This implies that moraic nasals are never realized in an 'onset' position. If the latter syllabifications were possible, Japanese would have to allow a consonant cluster NC to occur syllable initially, or the moraic nasal would lose its moraicity, and become an onset consonant to a following vowel. For example, the word *kaNi* is never realized as *[ka.ni], but as [kaN̩.i]. Put in a different way, the position in which a N appears is always syllable-final. Thus, it is easy to see why the moraic nasals may not begin a word: it is because of their permitted position in a syllable.

In addition, insights from discussion about the accent bearer made by Kubozono (see 5.2.2) provide further evidence that Japanese requires syllable nodes. He exploits the existence of a syllable domain to account for the mechanism of accent shift which occurs within a syllable, but never across a syllable boundary.

5. 3. 2 The Syllabification of Moraic Nasals in Ordinary Cases

The moraic nasals are always realized as a melodic segment associated with the second mora of a syllable. In the literature, no objection has been voiced concerning the syllabification of moraic nasals which appear word-finally or precede other syllables. When moraic nasals are followed by a geminate consonant however, they will need closer examination, as in 5.3.3. In this section two types of ordinary case are considered: the CVN type and the CVVN type. However, the second case seems at first glance to be a special case.

5. 3. 2. 1 The syllabification of CVN sequences

It may be accepted without further consideration that the so-called unmarked condition of moraic nasals is to be syllabified as post-vocalic segments and to retain their moraicity, and so contribute to syllable weight. As a consequence, the syllable a moraic nasal belongs to is always classified as heavy. Examples are shown in (11).

(11)

keN	'ticket, prefecture'	
keN.ka	'fight/quarrel'	
keN.kai	'opinion'	(keN 'see' + kai 'understand')
keN.koo	'health'	(keN 'healthy' + koo 'health')
keN.kiN	'donation'	(keN 'give' + kiN 'money')
keN.ke.tu	'blood donation'	(keN 'give' + ketu 'blood')
		(. indicates a syllable boundary)

In order for the moraic nasals seen in the examples in (11) to be syllabified as the second morae of syllables, we must see Japanese as rejecting the Margin Creation Rule. However, not all types of segments are allowed to be linked to the second mora, and therefore, a condition governing the nature of the second mora will be required.

A position with which the moraic nasals or the moraic obstruents are associated might seem to parallel the so-called 'coda' position. In fact, since in the moraic theory, the term 'coda' does not have any formal status, it will not be compatible with any kind of 'coda condition' as formed for Japanese. Nonetheless, it may be worth investigating this subject. Itô's (1986) Japanese Coda Condition is examined.

(12) Japanese Coda Condition : * C]σ
|
[-nas]

(Itô 1986: 27)

This condition says that non-nasal segments are not allowed to associate with the coda position. Therefore, the N of words such as *aN*, *paN*, *keN.ka*, etc. clears the condition and may be syllabified in the coda position.

However, a moraic part of a geminate consonant such as the second *k* of *kek.ka* 'result' is also realized in the post-vocalic position, where moraic nasals appear. Even though words containing a geminate consonant are well attested in Japanese, the condition in (12) excludes such well-formed cases.

However, arguing from Hayes's (1986: 331) 'Linking Constraint' (henceforth LC), as stated in (13), Itô (op. cit.: 26) discusses this case as follows; a closer inspection of the coda condition (12) reveals that it is only when a single association line occurs linking the coda node and a non-nasal segment that the structure is banned.

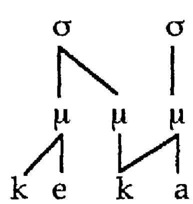
(13) Linking Constraint

Association lines in structural descriptions are interpreted as exhaustive.

(Hayes 1986: 331)

This permits the association of the moraic part of a geminate consonant to the coda position, since a geminate consonant would be doubly linked. The diagram in (14) illustrates the association involving a geminate consonant.

(14) Association of geminate consonant



Comparing the association lines in (12) and (14), the difference is clearly seen: one is * C] and the other is C]
| |/
[-nas] [-nas]. The Coda Condition (12), which accords with the LC, is not applicable to a multiply-linked form; thus, an association of the moraic part of geminate consonant with the coda position is allowed regardless of such a segment having non-nasal feature specifications.

A rather complicated explanation is required by Itô's Coda Condition. Before I propose what I shall call the Second Mora Condition, we may ask whether or not the moraic nasals and the moraic obstruents found in geminate consonants such as *kk*, *tt*, etc. could be treated on the same ground. In fact, the moraic obstruents do not simply close a syllable, they also link to the following mora, which is associated with a distinct syllable. Thus it could be said that while the moraic nasals close a syllable, the other moraic obstruents do more than this. Furthermore, if the term 'coda' denotes the last part of a syllable, then the 'coda' strictly refers to a single linkage between that position and a segment.

However, in the moraic theory employed here, it is possible to state a unified condition. Moraic nasals constitute a subset of consonants linked to the second mora of a syllable. Moreover, the moraic obstruents are also associated with the second mora of a syllable. Not only are these post-vocalic consonants linked to the second mora of a syllable, but so are the second elements of vowel sequences including bisegmental long vowels (see 2.1.4.1). The Second Mora Condition, which I shall propose shortly, includes all these segment types.

Although Itô's condition manages to refer to nasals and the first component of geminate consonants as a class, i.e., the class of segment type permitted in her coda position, it has no way of referring to the second element of vowel sequences including bisegmental long vowels, as these segments could certainly not be linked to C in C]σ. Thus, Itô's condition captures a relatively small generalization compared with the larger and much simpler generalization expressed in the Second Mora Condition in (15).

(15) Second Mora Condition (abbreviated to SMC)

The second mora in a heavy syllable may consist of any mora that has survived the operation of the Onset Creation Rule.

The SMC (15) predicts that the following segments may be associated with the second mora of a syllable: *N, i, e, a, o,* or *u,* and *p, s, t,* or *k,* when it is the component of geminate consonant. Within the framework of Hyman (1985), the non-occurrence of the Margin Creation Rule in Japanese could be seen as an alternative expression of the SMC.[14] The SMC also predicts geminate nasals; for example, *oNna* *o*[n:]*a* 'woman' and *saNma* *sa*[m:]*a* '(Pacific) saury'.

Moreover, moraic nasals and moraic obstruents further require a constraint which prevents them from constructing an independent syllable

[14] This is also true in the mora dialects other than (Standard) Japanese, while in the syllabeme dialects the MCR seems to operate (see 1.2.3.1).

from the preceding mora. Such a constraint on a moraic consonant can be stated as in (16).

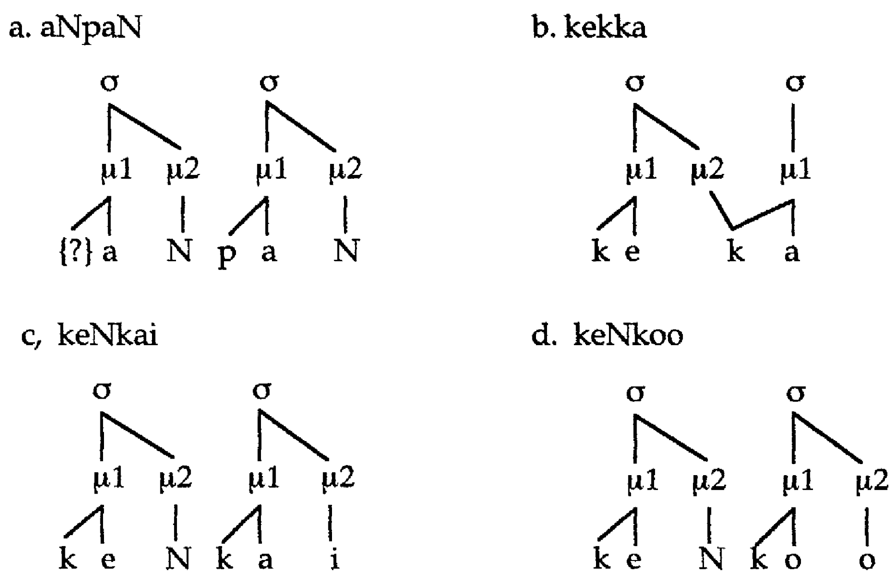
(16) Moraic Consonant Constraint (MCC)

A moraic consonant is never realized as the first mora of a syllable.

The MCC together with the SMC predicts that no intervening segment, even a bare root node, occurring between a moraic consonant and a preceding segment will be found; thus it does not come to be the nucleus of a syllable.

The syllabification of words such as *aNpaN* 'bean paste bun', *kekka* 'result', *keNkai* 'opinion', *keNkoo* 'health' is diagrammed in (17). A bi-segmental syllabification is postulated for the representation of a long vowel (see 2.1.4.1).

(17)



In sum, the syllabification of the moraic nasals involves the same syllable structures as those for geminate consonants and vowel sequences, because moraic obstruents and the second part of vowel sequences, along with moraic nasals, are all associated with the second mora of a syllable. As a result syllables containing post-vocalic consonants or vowel sequences are all categorized as heavy.

5. 3. 2. 2 The syllabification of CVVN sequences in Sino-Japanese compounds

We frequently find a CV_1V_2N ($V_1=V_2$, $V_1 \neq V_2$) sequence in Sino-Japanese (hereafter S-J) compounds. These are mainly made up of two or more S-J morphemes with *Jion* pronunciation (*On-yomi*), which refers to the Japanized pronunciation of a Chinese character. In such compounds, a morpheme boundary is always found between V_1 and V_2. The 'compounds' in Japanese need to be defined in a rather broader sense than that of the general definition, especially when S-J compounds are concerned. Tsujimura (1996: 151) states that many of the S-J compounds were formed in Chinese itself, and have been borrowed as complete compounds so that each of the components does not necessarily correspond to any individual word in Japanese. Some examples are given in (18).[15]

(18)

a.	si 'thought' + aN 'idea, plan'	→	siaN	'thought'
	aku 'evil' + uN 'luck'	→	akuuN	'bad luck'
b.	si 'child' + iN 'sound'	→	siiN	'consonant'
	si 'purple' + uN 'cloud'	→	siuN	'purple cloud'
	si 'support' + eN 'assistance, aid'	→	sieN	'support'
	si ' tooth' + oN 'sound'	→	sioN	'dental sound'
	eki 'station' + iN 'staff'	→	ekiiN	'station employee'
	kaisya 'company' + iN 'staff'	→	kaisyaiN	'office worker'
	doobutu 'animal' + eN 'place'	→	doobutueN	'zoo'
	syokubutu 'plant' + eN 'place'	→	syokubutueN	'botanical garden'

Examples in (18) are divided into two groups based on the type of the second morphemes: (i) a free morpheme such as *aN* and *uN*, as in (18a), which may be used as independent nouns; for example, a morpheme *uN* 'luck' is quite often used as a noun on its own, e.g., *uN-ga* *tukita* '(I) ran out of luck';
'luck-sb.' 'run out (past tense)'

[15] The pronunciation of examples such as those in (18) is *Jion (On-yomi)*, which is a modified Chinese pronunciation (see 2.1.3 fn 14). One pronunciation is sometimes assigned to different Chinese characters, hence there are many instances involving the same pronunciation though they involve different Chinese characters and have different meanings. On the other hand, one Chinese character may be pronounced in more than one way; for example, the Chinese character for 'sound' has at least two different pronunciations as in the example, i.e., *iN* and *oN*.

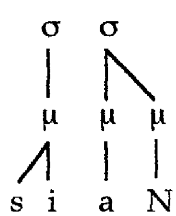
(ii) a morpheme which is not used on its own but only as a formative in a word with another morpheme; theses are prefixes or suffixes, i.e., bound morphemes, as in (18b).

Firstly, the traditional syllabification for a CV_1V_2N ($V_1=V_2$, $V_1\neq V_2$) sequence is outlined, and subsequently a moraic analysis is given.

5. 3. 2. 2. 1 The traditional analysis

In the literature, it is generally accepted that a CV_1V_2N ($V_1=V_2$, $V_1\neq V_2$) sequence in S-J compounds consists of a monomoraic syllable followed by a bimoraic syllable, i.e., $CV_1V_2N \rightarrow CV_1.V_2N$. This syllabification is considered regardless of the type of the second morpheme as specified above. The word *siaN* would be diagrammed as in (19).

(19) siaN



The syllable structure of *siaN* in (19) seems to be the right one, and such a syllabification would also be considered for words such as *eki-iN*, as in (18b). However, under the moraic theory employed here, the second syllable is problematic; it is onsetless. Such a syllable does not satisfy the condition for constructing syllables in the moraic approach used here.

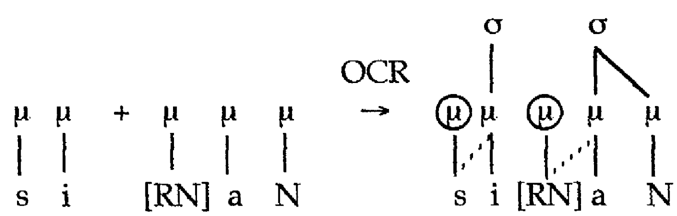
5. 3. 2. 2. 2 The moraic analysis

In the moraic analysis, treatment of vowel-initial morphemes could be accounted for with the ideas of Lexical Phonology. As Tsujimura states concerning the S-J compounds (see 5.3.2.2), I assume that both the smallest S-J morphemes, which correspond to one Chinense character, and S-J compounds made up of such morphemes exist in the lexical phonology.[16, 17] When a S-J compound involves a vowel-initial morpheme not as the first element, I assume that such a vowel-initial morpheme, whether free or bound, contains an inherent bare root node (hereafter, an inherent root node). This assumption could be made not only for a morpheme consisting of a V and a N as under discussion here, but also for any sequence which begins with a vowel, including morphemes consisting of a vowel only. In addition, larger compounds could be formed by concatenation of two or more S-J morphemes and/or S-J compounds; for example, *koo+aN - i+iN - kai* 'public'+'peace' - 'commit'+'person' - 'association' → *kooaNiiNkai* 'the Public Safety Commission'. Such compounds might be found in, say, Level 1 in the lexical phonology, and I also assume that any vowel-initial morpheme immediately preceded by a morpheme boundary contains an inherent root node. Thus, a compound *koo+aN - i+iN - kai* could be syllabified as koo.[RN]aN.[RN]i.[RN]iN.kai (where . indicates a syllable boundary).

Hence, under the current theory, the syllable structure for *siaN* would be as in (20).

(20)

a. b.



(20a) shows a morpheme boundary between *si* and *aN*. Since the second morpheme *aN* begins with a vowel orthographically, an inherent root node is postulated, which plays a role as an onset to the vowel *a* and the following moraic nasal to render them syllabifiable. As can be seen in (20a), an inherent root node is associated with its own mora at the outset, thus it undergoes the OCR. This point differs from glottal stop epenthesis, which does not undergo the rule, as we will see shortly. The same syllabification is expected for any

[16] It is usually understood that most of S-J compounds consist of two morphemes, i.e., two Chinese characters, but they function as one morpheme (see Nomura 1977: 251). Such morphemes could be called compounded morphemes and they should be treated in the same way as the simple morpheme (see Morioka 1969 [in Nomura 1977]).

[17] The theory of Lexical Phonology (LP) seems not to have been widely applied to Japanese. I employ the ideas of LP in order to account only for this issue.

other vowel-initial morphemes when they appear immediately after a morpheme boundary in the lexical phonology.

With regard to a morpheme beginning with a vowel orthographically, I assume that glottal stop epenthesis occurs in the post-lexical phonology.[18] This assumption could be proved by perception of a glottal stop when a vowel-initial morpheme, regardless of its position in a phrase is uttered. For example, when a noun phrase *akai-iro* 'red colour' is pronounced, a glottal stop is heard before the vowels *a* and *i* of *akai* and *iro* respectively; thus {ʔ}a.kai.{ʔ}i.ro. This could also be the case for vowel-initial lexical items. Therefore, a word *eki-iN* 'station worker' in (18b) will be syllabified as {ʔ}e.ki.[RN]iN. Moreover, a glottal stop may also be perceived when vowel-initial particles such as *o* 'object markar' and *e* 'direction marker' are uttered in a phrase/sentence, as was discussed in 2.4.5.3. Therefore, an epenthetic glottal stop is also considered for such a case in the post-lexical phonology. Note that as mentioned in 1.2.4.3.1, following Hyman (1985: 65), such an epenthetic segment is not introduced with a mora, and hence it does not undergo the OCR.[19]

To conclude, an inherent [RN] is postulated for the vowel-initial morphemes, regardless of morpheme types, when they are immediately preceded by a morpheme boundary in the lexical phonology. Such an inherent root node undergoes the OCR. Epenthesis of a glottal stop occurs in the case of an orthographically vowel-initial word/morpheme found in the post-lexical phonology. Unlike an inherent root node, an epenthetic glottal stop does not undergo the OCR.

5. 3. 2. 3 The syllabification of CVNV((C)V) sequence

In this subsection, I shall examine whether or not resyllabification occurs in compounds containing a moraic nasal followed by a vowel-initial morpheme; in other words, whether after compounding a moraic nasal becomes an onset consonant of the second morpheme or not. We might assume on the basis of discussion so far that such resyllabification would not happen.

$CV_1NV_2((C)V_3)$ sequences result from S-J compounds in which the second morpheme begins with a vowel; viz., in a $CV_1NV_2((C)V_3)$ sequence, a syllable boundary occurs between N and V_2. For example, words such as *kaNi* (*kaN +i*) 'simple', *keNeki* (*keN +eki*) 'quarantine' and *siNai* (*siN + ai*) 'dear/deep

[18] This assumption could also be true for other epenthetic segments, such as w-glide and y-glide, found in KiMvita (see 2.4.5.2).

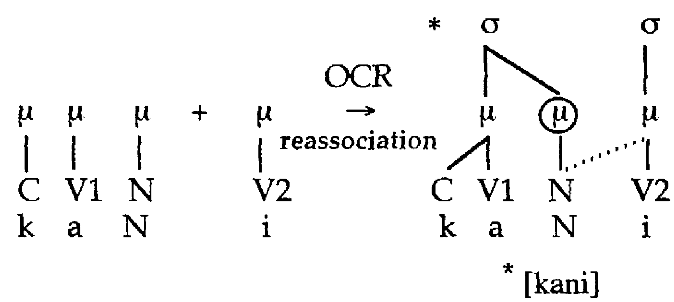
[19] See fn 35 in chapter 1.

affection' are all compounds involving a first morpheme ending in a moraic nasal and a second morpheme which begins with a vowel, at least orthographically. After the concatenation of the two morphemes takes place, a moraic nasal belonging to the first morpheme would seem to be a possible candidate for becoming an onset consonant for the following onsetless morpheme. This assumption stems from Mohanan (1979), who suggests; "syllabic consonants are universally ruled out between vowels" (in Hyman 1985: 38). However, no such a case is attested in Japanese. As has just been discussed above, a vowel-initial morpheme may have an inherent root node when it occurs not as the first morpheme in a compound, and consequently a vowel-initial morpheme can be syllabified. Hence, an inherent root node prevents a *N* from becoming an onset consonant to the vowel-initial second morpheme. One implication of this fact is that in Japanese the moraicity with which a post-vocalic nasal consonant is represented at the beginning of phonology is never a target for losing it later in the phonology.

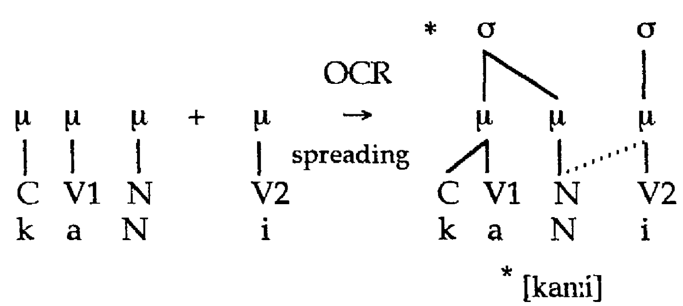
Two derivations, which are both unattested, are illustrated in (21).

(21)

a.



b.

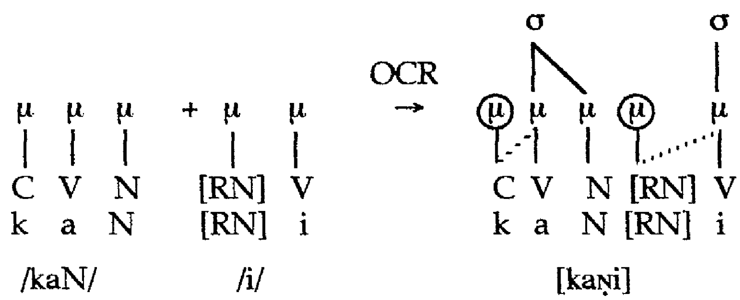


(21a) is pronounced as [kani], rather than as [kaN̩i], which happens to be a one morpheme word and means 'crab'. (21b) is pronounced as [kaŋ:i], which actually is found as a part of a word *kaNnin* 'patience, forgiveness'. Thus, it clearly shows that no resyllabification of moraic nasals is observed in S-J compounds.[20]

The right syllable structure for the CV1NV2((C)V3) sequence is shown in (22). In accordance with the discussion about the syllabification of the vowel-initial second morpheme in the previous section, an inherent root node is found before the second vowel-initial morpheme *i*.

(22)

a. b.



The diagram (22a) exhibits an inherent root node which is found before the vowel-initial second morpheme. In (22b), the inherent [RN] is seen as an onset to the vowel *i* of the S-J compound *kaNi*, and hence it is pronounced as [kaṆi].

To summarize this section, the moraicity of a moraic nasal is never threatened; in other words, a moraic nasal never loses its moraic status throughout the phonology in Japanese. Regarding the syllabification of a word containing a CVN sequence followed by a vowel-initial morpheme, a hypothesis positing an inherent root node is adopted, and such an inherent root node plays a role as an onset to the following vowel-initial morpheme.

5. 3. 3 The Syllabification of Moraic Nasals/Obstruents in Special Cases

In this section, trimoraic sequences containing a moraic nasal and/or a moraic obstruent are examined: the CV1V2N (V1=V2, V1≠V2) sequences found in loanwords and the CVNÇ or CV1V2Ç (V1=V2, V1≠V2) sequences found both in compounds and in verbal derivation. In the former, words such as *kureeN* 'crane' and *dezaiN* 'design' are focused upon, while in the latter, compounds such as *roNdoNkko* 'Londoner', *tookyookko* 'a person who is native to Tokyo', *geNdaikko* 'a child of today', *tootta* 'pass-past' and *haitta* 'enter-past' (the last

[20] It is easily assumed that a moraic nasal never loses its moraicity in the post-lexical phonology either.

two examples result from verbal derivation) are examined. Traditionally, such sequences are analyzed as involving a trimoraic (super-heavy) syllable type. Recently, Kubozono (1995) analyzes them invoking the second mora constraint on what may be the accent bearer, which avoids the recognition of trimoraic syllables. Firstly, trimoraic sequences found in loanwords are discussed in the following subsection. This is followed by discussion of such sequences in compounds and past tense forms.

5. 3. 3. 1 The syllabification of CVVN sequences in loanwords

There is an inconsistency. On the one hand, the CV1V2N (V1=V2, V1≠V2) sequences found in the S-J compounds are treated as unmarked cases, while on the other hand, similar sequences found in loanwords are traditionally regarded as marked, i.e., the CV1V2N sequence is syllabified into a trimoraic syllable, especially when it is monosyllabic in the source language.[21] However, a recent analysis suggests that a CV1V2N sequence is better syllabified as CV1.V2N, but only when the accent falls on V2.

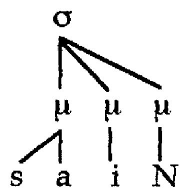
5. 3. 3. 1. 1 Kubozono's account

Kubozono (1995) suggests that the accent assignment rule could provide evidence for a more appropriate syllabification of CV1V2N (V1=V2, V1 ≠ V2) sequences in loanwords. First of all, a traditional syllabification for loanwords involving a CV1V2N (V1=V2, V1 ≠ V2) sequence, such as *saiN* 'sign' or *kureeN* 'crane', is given in (23).

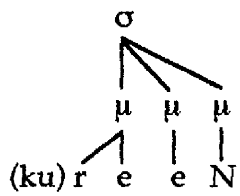
[21] Not all loanwords containing the CVVN sequence are syllabified into a (seemingly) trimoraic syllable. According to Lovins (1975: 65-66), long vowels or diphthongs followed by a nasal get shortened when the source words containing the CVVN sequence are borrowed into Japanese. This process is called 'Pre-Nasal Shortening (PNS)'. Kubozono (1995: 238) states that this phenomenon frequently occurs to those source words which contain more than one syllable, while the PNS does not affect most words consisting of one syllable in a source language. The PNS is seen in words such as *m*/ eN/ *tenaNsu* ← m/ ein/ tenance 'maintenance', *gur*/ aN/ *do* ← gr/ aun/ d 'ground', and *mas* / iN/ ← mas/ i:n/ 'machine'. (examples are taken from Kubozono op. cit.: 237).

(23)

a. saiN



b. kureeN



However, when loanwords involving a trimoraic sequence appear in compounds, accent sometimes falls on the second mora, V2 of CV1V2N; for example, *dezaiN* 'design' but *dezaiNhaku* (←*dezaiN* +*hakuraNkai* 'exposition') 'design expo'.[22] Kubozono (1995) suggests that the accent assignment rule could provide evidence for a more appropriate syllabification of such CV1V2N sequences in loanwords involving compounds. Accent normally falls on the first mora, but the sequences under discussion here bear accent on the second mora. If accent were assigned to the second mora, it would normally be adjusted by an accent shift process. Kubozono assumes that there is a syllable boundary between the first and the second morae in these forms, so that their failure to obey the first mora assignment, which requires a further accent shift process, is easily explained. Thus a trimoraic sequence is syllabified as CV1.V2N.

In (24), the words *dezaiN* 'design', *dezaiNhaku* 'design expo' and *dezainaa* 'designer' will be examined according to Kubozono's account, where CAR and AR stand respectively for 'Compound Accent Rule' and 'Accent Adjustment Rule'.[23] Note that the term 'Underlying Form' in (25) and (26) indicates that the examples have undergone the Accent Assignment Rule (AAR), given in 5.2.3, which says that accent is assigned to the antepenultimate mora.

---

[22] There is a tendency towards truncation in Japanese. When polymoraic words appear as components of compounds, truncation normally operates. Hence the word *hakuraNkai* is truncated to *haku* in the compound *dezaiNhaku*. This phenomenon is also seen in loanwords, for example, *toire (tto)* 'toilet', *suto(raiki)* 'strike', *zenesuto* (*zene(raru)*+*suto(raiki)*) 'general strike' (see Itô 1990, Mester 1990, Kubozono 1995 for details).

[23] See Kubozono (1995: 242) for more examples.

(24)

	dezaiN	dezaiNhaku	dezainaa
Underlying Form:	dez*aiN	dez*aiN + haku	deza*inaa
CAR:	——	dezai*Nhaku	——
AR:	——	deza*iNhaku	dez*ainaa
Output:	dez*aiN	deza*iNhaku	dez*ainaa

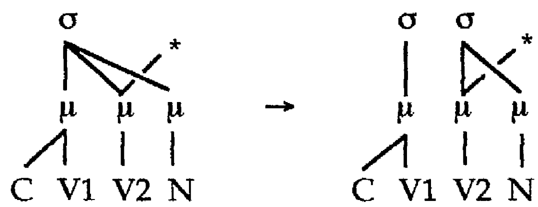
(Kubozono, 1995: 241)

In accordance with the AAR, in*dezaiN* and *dezainaa*, the accent is borne by *a* of *dezaiN* and by *i* of *dezainaa*, which are associating with the antepenultimate mora respectively. However, the vowel *i* of *dezainaa* is the second mora of the syllable *zai*, which is not the preferred accent bearer, and therefore, accent shifts to the first mora linked to the vowel *a*. Regarding the compound *dezaiNhaku*, it undergoes the CAR (see Kubozono 1987, 1995). In this case, since the second morpheme is a bimoraic word, the accent falls on the last mora of the first morpheme, which is a moraic nasal, N.[24] The N is not the preferred accent bearer, therefore the AR (equivalent to the Accent Shift Rule postulated in (9) above) operates, and as a result, the accent shifts to the preceding mora, associated with the vowel *i*. Although the vowel *i* is associated with a mora which is not the preferred one for the accent bearer, no further accent shift occurs. Thus, syllabification of the CV1*V2N sequence of *deza*iNhaku*, yields CV1.*V2N, i.e., *za.*iN*. In this syllabification, the accent bearer is the first mora of the syllable. This resyllabification suggests that Japanese phonology avoids a trimoraic syllable if at all possible (Kubozono 1995: 241). The diagrams are shown in (25).

[24] The AAR, which is applicable to polymoraic nouns, compounds and loanwords, is compatible with Kubozono's CAR in this instance. While the CAR also deals with the case in which the second morpheme is a one-mora word, the AAR does not affect it. Even though the explanation is slightly different for the second morpheme which is more than one-mora long word, the result is the same, namely that the accent is assigned to the antepenultimate mora, as the last mora of the first morpheme is the antepenult anyway.

(25)

a. b.



(Kubozono 1995: 242)
(asterisk is mine)

To sum up so far, a CV1V2N sequence in loanwords, which apparently shows no internal morpheme boundaries, seems to have to be categorized as a marked case and thus involve a trimoraic syllable when it appears on its own. However, from an argument based on an exceptionless constraint on accent location, resyllabification of the sequence occurs when the second mora becomes the accent bearer, which occurs when such a sequence forms a compound. Consequently such a CV1V2N sequence comes to consist of a monomoraic syllable followed by a bimoraic syllable, i.e., CV1.V2N.

This kind of resyllabification phenomenon, argued for on the basis of the accent location, can also be proposed in a case where a long vowel is followed by a moraic nasal. I shall cite the derivation of compounds such as *tyeeNteN* (←*tyeeN* 'chain' + *teN* 'store') 'chain store', and *kureeNsya* (←*kureeN* 'crane' + *sya* 'car') 'crane' from Kubozono (op. cit.: 242-243). The accent location of these words are as in (26).[25]

(26)

	tyeeNteN	kureeNsya
Base Form:	ty$\overset{*}{e}$eN + t$\overset{*}{e}$N	kur$\overset{*}{e}$eN + sya
CAR:	tyee$\overset{*}{N}$teN	kuree$\overset{*}{N}$sya
AR:	tye$\overset{*}{e}$NteN	kure$\overset{*}{e}$Nsya
Output I.	tye$\overset{*}{e}$NteN	kure$\overset{*}{e}$Nsya
	or	or
II.	ty$\overset{*}{e}$eNteN	kur$\overset{*}{e}$eNsyaa

The outputs of the two compounds show two possible accent locations. The second mora of a long vowel bearing the accent is seen in Output I, whereas

[25] As in (26), accent is assigned to all components of a compound by a rule or in the lexicon; *sya* is unaccented.

the first mora of the long vowel bears the accent in Output II; schematically, $V1\overset{*}{V}2$ and $\overset{*}{V}1V2$. Kubozono (op. cit.: 242) explains this variability of accent location as follows; if the accent falls on the V2, the syllabification of the CV1V2N becomes $CV1.\overset{*}{V}2N$; on the other hand, if the V1 bears the accent then the CV1V2N sequence is syllabified as a trimoraic syllable, thus $C\overset{*}{V}1V2N$.

To sum up, in Kubozono's analysis, when the second mora of a trimoraic sequence, CV1V2N (V1=V2, V1≠V2) as found in loanwords, bears accent, the sequence is understood to consist of a monomoraic syllable followed by a bimoraic syllable. Kubozono extends this analysis to the sequences of CVNÇ or CV1V2Ç (V1=V2, V1≠V2) found in Japanese compounds, recognizing the fact that the accent does not shift from the N/V2 to the V1, which implies that a trimoraic sequence consists of a monomoraic and a bimoraic syllables (1995: 243). Discussion of this matter will be undertaken later, together with consideration of a traditional analysis and also a revised analysis proposed under the current theory.

In the next subsection, the syllable structure proposed for the CV1V2N sequence is examined according to the framework employed in this thesis.

5. 3. 3. 1. 2 The moraic analysis

Kubozono's account of the trimoraic sequences involving a moraic nasal as found in loanwords proceeds by proposing a new syllabification for these sequences: a trimoraic sequence consists of a monomoraic syllable followed by a bimoraic syllable, whenever the accent is assigned to the second mora.

However, Kubozono's account of the syllabification of the trimoraic sequence suggests one point to be criticized under the current theory, and also raises a question. The point for criticism is that it allows a bimoraic syllable, V2N, which shows no onset in its structure; this is not allowed under the current theory. The question to be asked is as to whether or not the CV1V2N sequence needs two types of syllabification on the basis of the accent location.

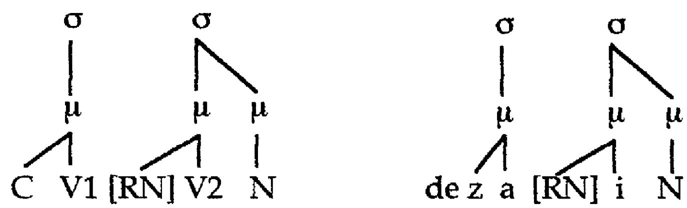
With regard to the onsetless bimoraic syllable, under the current theory an onset is an essential constituent for the construction of a syllable, thus it should be provided in some way. This type of problem may arise when other types of trimoraic sequences in compounds are discussed. Thus, the discussion about onsetless syllables in loanwords could be regarded as a tentative one.

Recall that the CV1V2N sequences found in the S-J compounds consist of a monomoraic syllable, CV1, and a bimoraic syllable, V2N, and the vowel-initial morpheme, V2N, regardless of being a free or a bound morpheme, has an inherent root node which plays the role as an onset to the V2N sequence.

A trimoraic sequence in loanwords under discussion here shares the same segmental configuration as the S-J compounds, CV1V2N; thus, it is plausible to assume that the inherent root node is taken into consideration for this case. Consequently, the CV1V2N sequence in loanwords is also syllabified as CV1.[RN]V2N. The syllable structure of the CV1V2N sequence in loanwords under the current theory is depicted in (27). (27a) is a generalized form and (27b) exemplifies the word *dezaiN*.

(27)

a. b.



To sum up so far, CV1V2N sequences in loanwords also have inherent root nodes as in the case of S-J compounds as discussed in 5.3.2.2.2.

Concerning the two types of syllabification according to the accent location, if the accent location is the evidence for a trimoraic sequence to be syllabified as a monomoraic plus a bimoraic syllables, as Kubozono argues, it would not be implausible to postulate that the CV1V2N sequence in which it is V1 that is accented also has a possibility of consisting of a monomoraic plus a bimoraic syllable, i.e., to postulate that the same sequence could have the same syllabification regardless of the accent location. Moreover, V1 is always associated with the first mora in either syllable structure. If this is justified, then the syllabification of the CV1V2N in loanwords requires one type of structure to be recognized, CV1.[RN]V2N.

5. 3. 3. 2 The syllabification of CVNÇ or CVVÇ sequences in compounds

The second type of trimoraic sequence arises as a result of the composition of two morphemes. It is composed of a bimoraic syllable, CVN or CV1V2 (V1=V2, V1≠V2), followed by a moraic obstruent; thus CVNÇ or CV1V2Ç (V1=V2, V1≠V2). These sequences are found either in compounds or in past tense forms of certain verbs. In the compounds, these sequences occur when the morpheme *-kko* 'child' is affixed to a stem ending in a N or in a vowel sequence such as *roNdoN* 'London', *tookyoo* 'Tokyo', and *geNdai* 'the present/modern age'.[26] Another source of such forms is when a past tense morpheme *-ta* is affixed to a bimoraic verb stem such as *toor-* 'pass', *hair-* 'enter' in verbal inflection.[27] As in the case of loanwords, these sequences are traditionally syllabified into a trimoraic syllable and considered as marked cases. As mentioned above, Kubozono applies the same analysis discussed for loanwords to the compounds. Thus, the same problem arises concerning the syllabification of the bimoraic syllable under the current theory. Firstly, the traditional analysis of the syllabification of these sequences is sketched out, and this is followed by a discussion of the more recent analysis based on Kubozono's account. Then, I shall revise the two analyses in connection with the CV1V2Ç sequences found in the past tense forms.

5. 3. 3. 2. 1 The traditional analysis

A word containing the CVNÇ or the CV1V2Ç (V1=V2, V1≠V2) sequence is traditionally syllabified as trimoraic, and treated as a marked type. The words given in (28) involve such trimoraic syllables.

(28) CVNÇ or CV1V2Ç in compounds

roNdoN + kko →	roNdoNkko	'Londoner'
tookyoo + kko →	tookyookko	'a person who is native to Tokyo'
geNdai + kko →	geNdaikko	'a person of today'

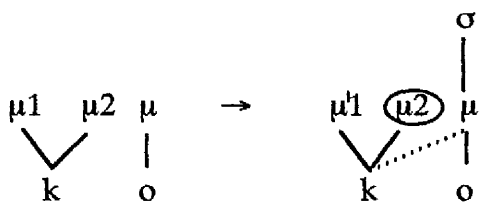
Before considering their syllable structures, the underlying form of these compounds will be examined.

The example words mentioned above are all composed of a morpheme ending with a moraic nasal or the second part of a vowel sequence and a morpheme *-kko* 'child (lit.)', which involves a geminate consonant structure. Following Hyman (1985: 14), a geminate segment is associated with two morae underlyingly, hence, the morpheme *-kko* could be represented as follows.

[26] There is a variation, where a morpheme *-ko* is affixed to the stems ending a bimoraic syllable, and the accent falls on the first mora of the bimoraic syllable, for example, *roNdo⃰Nko*. This type of pronunciation was attested before the *roNdoNkko* type started being used and such a type is still heard along with the new type. In Appendix E, the duration of N in the two types of compound, i.e., an accented N and an unaccented N, will be compared in terms of whether the duration of an accented N is long enough to be regarded as a segment of an independent syllable.

[27] See 5.3.3.3.

(29)



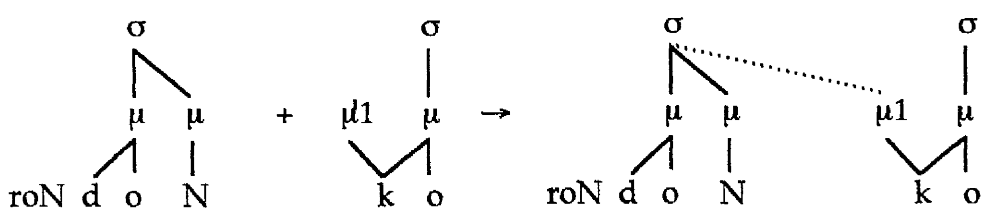
(μ' indicates an unsyllabified mora)

Syllabification in (29) would say that the geminate consonant *k* is linked to both μ1 and μ2 underlyingly, and the μ2 undergoes deletion during the Onset Creation Rule. As a result of the OCR, the *k* constitutes a syllable along with the vowel *o*; but this means μ1 of the geminate is as yet unsyllabified.

The unsyllabified μ1 linked to the consonant *k* seen in (29) finds a syllable node to be associated with when it is affixed to a morpheme such as *roNdoN*, etc. However, the syllable to which the unsyllabified μ1 is incorporated already contains two morae, thus after concatenation of the two morphemes, a trimoraic syllable is constructed.

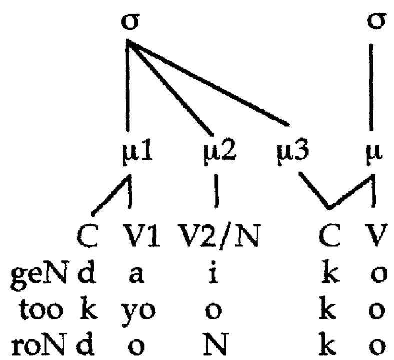
(30)

a.



The μ1 of a geminate consonant *k* is now realized as the third mora in such words as illustrated in (31).

(31)



Thus, it can be clearly seen that compounds involving the first morpheme ending with CVN or CV1V2 sequences and the second morpheme containing a geminate consonant in morpheme initial position create a trimoraic syllable.

Until recently, there had been no objection to this syllabification, however, it has now been rejected on the basis of accent location. A recent analysis for the syllabification of such forms advanced by Kubozono (1995) is looked at in the following section.

5. 3. 3. 2. 2 Kubozono's analysis

Recently, Kubozono (1995) has claimed that a NÇ or a V2Ç sequence in the CVNÇ or the CV1V2Ç should be syllabified independently from the preceding CV(1) syllable: i.e., CVNÇ → $[CV]_\sigma[NÇ]_\sigma$ or CV1V2Ç→ $[CV1]_\sigma[V2Ç]_\sigma$.[28]

Kubozono's claim apparently stems from the accent location consideration, as discussed in 5.3.3.1.1. Accent in such sequences is borne by the N or the V2, which is associated with the second mora, the non-preferred accent bearer. As mentioned above, Kubozono (1995: 243) observes that the fact that the accent assigned to the second mora of the leftmost morpheme, i.e., the N or the V2, by the CAR does not shift to the first mora suggests that there is a syllable boundary between the CV(1) and the N/V2.

Therefore, Kubozono (op. cit.) considers that the syllable structure for the CVNÇ or the CV1V2Ç sequences consists of a monomoraic plus a bimoraic syllables, which satisfies the condition governing the bearing of accent. His syllable structures for the CVNÇ and the CV1V2Ç sequences are depicted in (32).

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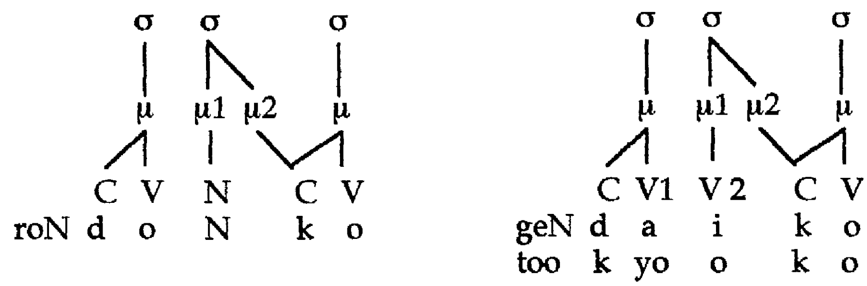
[28] Shirota (1993) also argues for such syllabification, although he discusses the matter from a different point of view: a segment which precedes a geminate consonant contains a nuclear characteristic. Thus the N is considered to be a nucleus of a NÇ syllable.

(32)

a. b.



According to his syllabification, the N or the V2 creates a bimoraic syllable along with the moraic part of a geminate consonant, and thus, the N or the V2 is no longer associated with the second mora. This is unlike the traditional syllable structure for the CVNÇ/CV1V2Ç sequences, where the N or the V2 is linked to the second mora. Since the N or the V2 is not linked to the second mora in Kubozono's syllable structure, it does not violate the accent bearer constraint. However, he does not mention the need for any onset for the NÇ or the V2Ç syllable.

To sum up, Kubozono's analysis of the trimoraic sequences, CVNÇ/CV1V2Ç, clearly relies on an assumption about the second mora of a syllable; i.e., that the second mora may not be the accent bearer. However, the same problem as that seen in the treatment of loanwords is also found here, as it assumes an onsetless syllable, which is not allowed under the theory employed here.

5. 3. 3. 2. 3 Revised analysis

Neither of the two analyses discussed above seem to show a satisfactory syllabification for either CVNÇ or CV1V2Ç sequences. On the one hand, the traditional analysis fails to satisfy the condition that the only accent bearer in a syllable must be the first mora. On the other hand, the recent analysis of Kubozono does satisfy that condition, but it fails to meet the conditions for constructing a syllable; an onset consonant is an essential component in constructing a syllable within the moraic theory this study employs, as discussed in chapter 2. I shall discuss the respective flaws of the two analyses and revise the syllabification of these problematic sequences. A revision of the recent analysis is considered first, and this is followed by consideration of a revision of the traditional analysis.

5. 3. 3. 2. 3. 1 Revision of Kubozono's analysis

The recent analysis advanced by Kubozono is superior to the traditional approach in terms of respecting the accent location. However, he displays the same flaw as that found in the case of loanwords. This is that in his syllable structures, the syllable containing a sequence of the moraic nasal and the moraic obstruent has no onset consonant. However, if there is a structural site for an onset consonant such as a glottal stop or even an inherent bare root node (hereafter an inherent root node), a syllable could be constituted from the N/V2 and the Ç.

It might be plausible to assume that an inherent root node is lexically present before the V2 or the N of CVNÇ or CV1V2Ç sequences, as has been discussed for the CVVN sequence in the loanwords. The possibility of there being a root node here requires careful investigation. An inherent root node is considered for the case of loanwords based on the same segmental configuration as that found in the S-J compounds. However, unlike the trimoraic sequences in the loanwords, those found in the compounds do not share the same segmental configuration; i.e., that the third mora is associated with a nasal in the S-J compounds and the loanwords, whereas it is associated with an obstruent in the compounds. The compounds actually share this segmental configuration with certain past tense verb forms, whose third mora is associated with an obstruent. As will be seen shortly, the CV1V2Ç sequences found in the past tense verb forms might not be broken down into two syllables.

There might be a solution that could resolve the problem created by Kubozono's account. It could be postulated that the moraic nasal projects an onset root node for itself, so that it can constitute a syllable. However, this hypothesis should also be rejected, since the Moraic Consonant Constraint stated in 5.3.2.1 forbids the moraic nasal to be the first mora, i.e., a nucleus of an independent syllable.

Regarding a possible onset segment before the V2, if a historical perspective is taken into consideration, there probably would have been a consonant there which would broke up the vowel sequence. However, this is not really a valid synchronic solution. Moreover, such a remedy could not be postulated for the N+Ç sequence.

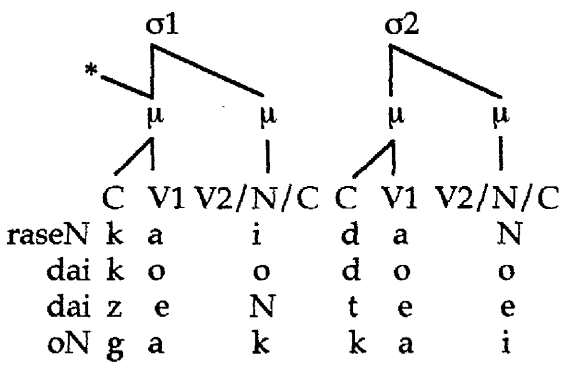
To sum up, in Kubozono's analysis, a syllable dominating the N+Ç sequence is onsetless, which is an illicit form under the current theory, and no strategy seems to be motivated for such an onsetless syllable.

5. 3. 3. 2. 3. 2 Revision of the traditional analysis

As has been apparent, the flaw in the traditional analysis for the syllabification of the trimoraic sequences is its violation of the accent location, which is borne by the second mora. In order to rectify this flaw, I shall propose a hypothesis regarding the accent bearer.

The accent assignment rule in (7) and the rule for accent shift in (9) imply that when the accent is assigned to the second mora of a (bimoraic) syllable, which is linked to a nasal, an obstruent or the second element of a vowel sequence (including a long vowel), it shifts to its left, i.e., to the first mora of the syllable. Viewed in another way, it might be that the *penultimate mora*, rather than the *first mora*, of the syllable is the preferred accent bearer. I call this the 'penultimate mora' hypothesis. A diagram is given in (33).[29] All examples have already undergone the accent assignment rule and the accent shift rule discussed above.

(33)



The accent in these examples is borne by the first mora of σ1, i.e., the penultimate mora of the syllable.

The penultimate mora hypothesis seems to work in most cases.[30] In fact, this hypothesis is also applicable and appears especially insightful in the case of compounds where the CVNÇ or the CV1V2Ç sequences are found. Compare the diagrams in (32) to the one in (34).

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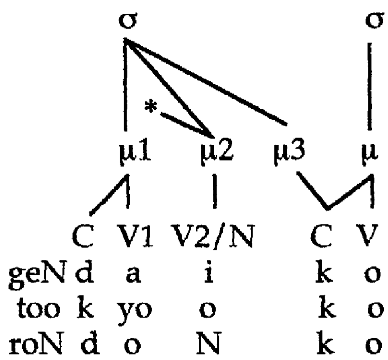
[29] In the diagram, a geminate consonant should be doubly linked, however, I use individual linkage in this case so that the segments associated with the second mora of a syllable are clearly seen. These are the moraic nasal, the moraic obstruent, and the second part of a vowel sequence including a long vowel.

[30] There is only one exception to this hypothesis which is the CVVÇ sequences involving certain verbal morphemes: these are discussed in the following subsection.

(34)

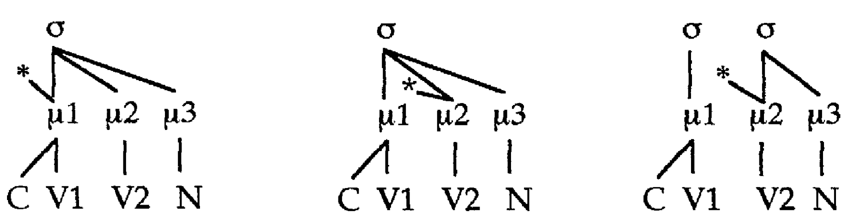


The penultimate mora hypothesis enables the traditional analysis to be upheld, since the accent bearer is the penultimate mora linked to the N, the Ç or the V2. Moreover, such a trimoraic syllable has an onset, and thus this does not share the weakness of the analysis of Kubozono.

Although the penultimate mora hypothesis is attractive and elegant in rectifying the flaw the traditional account has, a problem might arise as to how to deal with a case in which the antepenultimate mora of a trimoraic syllable bears the accent; this is found in loanwords, for example, words such as ty*eeNteN 'chain store' and kur*eeNsya 'crane'. In such compounds involving loanwords, the accent may be carried either by the antepenultimate mora of the CVVN sequence, the first *e*, or by the penultimate mora of it, the second *e*, (see 5.3.3.1.1). The penultimate hypothesis can handle the penultimate accented case, but it fails to do so in the case where the antepenultimate is accented.

(35)

a. b. c.



The diagram (35a) represents both the traditional and the recent accounts for the first mora (antepenult) accented case, such as s*aiN 'sign', kur*eeN 'crane', etc., while syllabifications of the second mora (penultimate) accented case based on the traditional and the recent analyses are illustrated in (35b) and (35c) respectively. While (35b) and (35c) accord with the penultimate hypothesis, the syllabification in (35a), in which not the penult but the antepenult bears accent, creates a problem for both approaches. In addition, accent location in certain past tense verb forms will be another problematic case if the penultimate mora hypothesis is adopted; since accent is borne by the first mora of a trimoraic syllable in such forms.

If the possible accent bearer is viewed from a different perspective, there might still be a possibility of supporting the traditional analysis. If the Accent Bearer Constraint (hereafter ABC) is posited so as to exclude the generally unpreferred accent bearer, i.e., the last mora, so that the last mora may not bear the accent, then all cases can be explained in a satisfactory manner. Even if the accent were assigned to the single mora of a monomoraic syllable, it would not have violated this constraint, because in such a case it would be reckoned as the first.

Before reaching a conclusion, I need to consider one more case, namely certain past tense verb forms containing $\mathrm{CV_1V_2}$Ç ($V_1=V_2$, $V_1 \neq V_2$) sequences.

5. 3. 3. 3 The syllabification of CVVÇ sequences in past tense verb forms

$\mathrm{CV_1V_2}$Ç ($V_1=V_2$, $V_1 \neq V_2$) sequences are also found in certain inflected forms of verbs, e.g., past tense forms such as *tootta* 'passed', *haitta* 'entered' and so forth.[31] The past tense form is created by suffixing the past tense morpheme *-ta* to the verb stem. For example, the past tense form *mita* 'saw' results from affixation of the past tense morpheme *-ta* to *mi,* which is the stem of the V-stem verb *mi-ru* 'see'.[32] Other V-stem verbs also undergo the same procedure to form their past tense forms.

However, formation of the past tense form for the C-stem verbs is not so simple as in the case of the V-stem verbs. Examples are given in (36).

(36)

a.	kak-u 'write'	kak + ta → kai.ta	'wrote'
b.	tob-u 'fly'	tob + ta → toN.da	'flew'
c.	kas-u 'lend'	kas + ta → ka.si.ta	'lent'
d.	tor-u 'take'	tor + ta → tot.ta	'took'

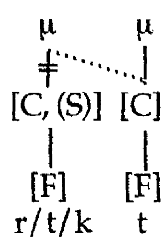
[31] There are a few more words containing the CVVÇ sequence resulting from verbal derivation; for example, *kootta* 'freeze - past' and *kaetta* 'return - past', etc.

[32] Japanese verbs are divided into two groups in terms of regularity of their conjugation pattern, regular verbs and irregular verbs. Only two verbs are found in the latter group, which are *iku* 'come' and *suru* 'do'. The former group is further divided into two subgroups depending on the segment which ends a stem; (i) the C-stem verbs or *u*-verbs, whose stems end in a consonant, e.g., *kak-u* 'write', *yom-u* 'read', etc., where a stem-final consonant is found as an onset to *-u*; (ii) the V-stem verbs or *ru*-verbs, whose stems end in a vowel, e.g., *ake-ru* 'open', *tabe-ru* 'eat', etc.

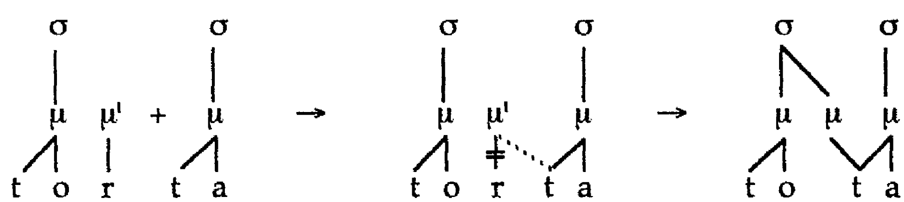
As can be seen in the output forms in (36), the past tense morpheme shows some alternants. Four different types of derivation are required to obtain such output; however, only one of them, namely the one involving a geminate consonant, is considered here.[33]

It is generally agreed that suffixation of the past tense morpheme *-ta* creates a geminate consonant as a result of total regressive assimilation, (see Kuroda 1965, McCawley 1968, Aoki 1981, and Yoshiba 1983). In the current approach, it can be explained by spreading the root node, i.e., all the features the *t* contains to the preceding mora which is associated with the stem-final consonant, and the simultaneous dissociation of that consonant's root node from the mora. The stem-final consonants affected by such a process are *r*, *t* and *k* (only with one verb, *iku* 'go'). The process is depicted in (37a) The past tense form of a verb *toru* 'take', which is *totta*, is exemplified in (37b), where the feature organization of segments is omitted.

(37) a.



b.



The diagrams (37b) show two processes: (i) dissociation of the stem final consonant; (ii) feature spreading. As in (29) above, the only syllable for the unsyllabified mora, associated with the consonant *t*, is the preceding syllable dominating *to* of *totta* 'took'.

Next, the case of past tense forms containing a CV1V2Ç sequence, as in (38), will be examined.

[33] For the three other types of derivation, see Kuroda (1965), McCawley (1968), Aoki (1981) and Yoshiba (1983).

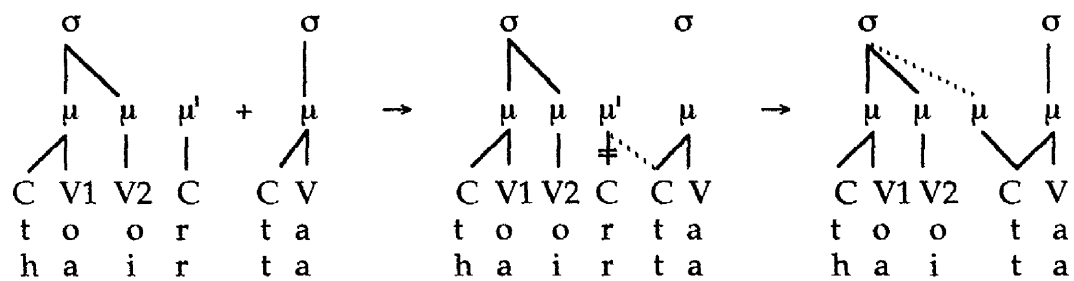
(38)

toor-u 'pass'	toor + ta → toot.ta	'passed'
hair-u 'enter'	hair + ta → hait.ta	'entered'

Syllabification for these words will follow the same process as in the case of *totta* in (37), but this suggests that a syllable structure for these past tense forms would involve a trimoraic syllable, since the stem syllable already contains two morae.

(39)

a. b. c.



The past tense formation, involving a geminate consonant, comes to create a trimoraic syllable whenever a stem contains two morae. A question may arise as to whether or not resyllabification is possible in this case. Like the compounds involving loanwords seen above, accent location could be a diagnostic in this matter. As shown in (40), the non-past tense forms for these words are *hairu* and *tooru*, and in these forms the accent bearers are the morae associated with the vowel *a* and the first vowel *o* respectively. In their past tense forms the accent bearers are the same. The accent bearer is always the first mora of the syllable.

(40)

	Non-past tense form	Past-tense form	Gloss
a.	h$\overset{*}{\text{a}}$iru	h$\overset{*}{\text{a}}$itta	'enter'
b.	t$\overset{*}{\text{o}}$oru	t$\overset{*}{\text{o}}$otta	'pass'

If the second mora of a syllable were the accent bearer in the past-tense form, it would suggest that resyllabification had taken place, as in the case of the loanwords involving compounds such as *dezaiNhaku* 'design exposition' discussed above. However, this is not the case here. Hence, the CV1V2Ç sequences arising in verbal inflection are syllabified into a trimoraic syllable, and the constraint against the last mora as accent bearer is also observed in this case.

5.3.3.4 Summary

There are two points to discuss concerning syllabification of the trimoraic sequences found in loanwords, compounds, and past tense verb forms within the moraic theory employed here: the question of onsetless syllables and the Accent Bearer Constraint (ABC).

Firstly, discussion of the trimoraic sequences, CVNÇ or CV1V2 Ç, found in compounds is summarized. The particular problem such sequences create is that the accent falls on the second mora, which violates the generally proposed ABC. Therefore it seems necessary to construct an independent syllable from the preceding CV(1) sequence. When the ABC is fulfilled, an onsetless syllable has to be admitted. However, no candidate to fill the onset position can be postulated for such sequences. On the other hand, when a trimoraic syllable is postulated, the ABC is violated. Such problems are rescued by the formulation of a revised ABC, i.e., that the last mora of a syllable may not bear accent. Employing this revised constraint, the trimoraic syllable analysis is considered adequate for such problematic sequences. This revised ABC is also applicable to past tense verb forms, where accent falls on the first mora, and where the only possible syllable type is trimoraic. Thus, in order to avoid onsetless syllables, this study opts for a trimoraic syllable analysis for any trimoraic sequences found in compounds and in past tense verb forms. In doing so it relies on the revised ABC.

Such a conclusion could also be taken into consideration for the case of loanwords. However, trimoraic sequences found in loanwords can be treated in a different way, since an inherent root node is available to fill the onset position. Recognizing a trimoraic syllable type should be regarded as special, and therefore a trimoraic sequence in loanwords is better analyzed as consisting of a monomoraic syllable followed by a bimoraic syllable, regardless of accent location, which is either the first or the second mora. Thus, unlike Kubozono's account, in the present analysis, there is only one type of syllable structure for the CV1V2N sequences in loanwords.

Conclusion

This thesis has explored the phonology of KiMvita and Japanese with respect to moraic nasals under the moraic theory based on Hyman's (1985) 'Weight Theory', together with employment of the ideas of Lexical Phonology and Feature Geometry. One prominent property shared by KiMvita and Japanese is that 'the mora' is the prosodic unit; the stress/accent assignment is counted by the mora, and the stress/accent is borne by the mora, though syllable nodes are also essential for both languages.

In the following sections, the findings from both a theoretical point of view and this investigation into KiMvita and Japanese are presented.

The theoretical findings

1. **The Least Syllable Condition (LSC)**
   Following Hyman's (1983, 1985) analysis of unsyllabified vowel sequences found in Gokana, the LSC is proposed. Construction of a syllable under the moraic theory employed in this thesis requires two constituents, an onset and a nucleus. In other words, a single constituent, either an onset or a nucleus on its own, may not construct a syllable and remains unsyllabified. The LSC has been invoked when syllabification of uninterrupted vowel sequences in Saho (Hayward 1997), KiMvita and Japanese is discussed. In Saho, Hayward (*ibid.*) advances the concept of the bare root node, which is characterized as either derived or inherent. In the case of KiMvita, between two vowels glide insertion is employed when the leftmost segment is either /i/, /u/, /e/ or /o/. When the leftmost vowel is /a/, it creates a diphthongal sequence, hence a bimoraic syllable is postulated. In Japanese, an inherent bare root node (hereafter an inherent root node) is posited when the non-initial element of compounds in general, including Sino-Japanese (S-J) compounds, begins with a vowel, and when the second element of a vowel sequence bears accent. In KiMvita and Japanese, a word-initial vowel may receive glottal epenthesis. In addition, in Japanese, a vowel-initial morpheme in a phrase/sentence may receive glottal stop insertion.

2. Two assumptions about syllabification

(i) The Onset Creation Rule (OCR) is the first rule to apply.

Underlying distinct segments all undergo the OCR first, and subsequently any additional rules may take place, for example, the Onset Adjunction Rule, in order to derive a surface unified segment; an example of this is the prenasalized obstruent in KiMvita. (In some other languages, the OAR may be considered so that an onset consonant cluster is formed.)

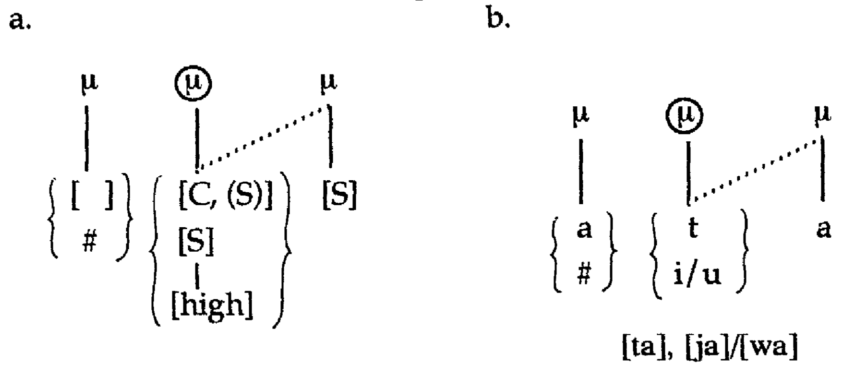
(ii) Directionality of syllabification is strictly left-to-right.

Unlike the templatic approach, as advocated by Itô (1986), only a left-to-right syllabification is allowed. Thus, onset maximization or coda maximization would not be explained by directionality of syllabification. KiMvita could be regarded as one of the onset maximization type languages, though it is limited to N+C sequences exhibiting Feature Linkage. If the language in question allows a complex margin ('coda'), a condition on this should be stated and respected.

3. Revision of Hyman's OCR and Glide Formation (GF)

Some flaws were found in Hyman's (1985) GF: (i) the most sonorous WU (=μ) is lost; and (ii) only the case which involves a glide as a component of a complex consonant is handled. These lead to a revision of his OCR, and to proposals for formations involving a high vocoid as a component of a labialized and velarized or a palatalized consonant on the one hand, and that of a component of a light diphthong on the other. These are Complex Consonant Formation (CCF) and Light Diphthong Formation (LDF) respectively. The revised OCR allows a sequence of [S]-[high][S] preceded by a moraic segment or a word boundary, as well as a [C, (S)] [S] sequence, to undergo the OCR. The revised OCR (see 4.2.1) is believed to be of value not only for KiMvita and Japanese but also for many languages. The revised OCR (17) in chapter 4 is repeated in (1).

(1) Revised Onset Creation Rule (in general)

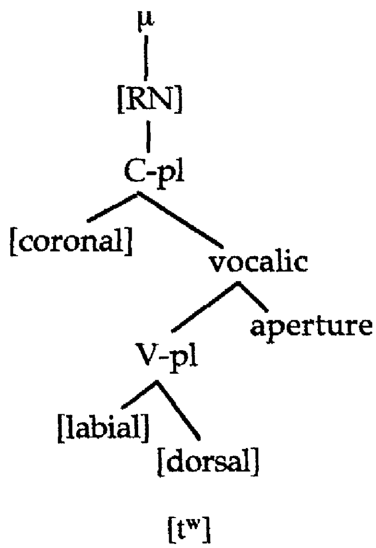


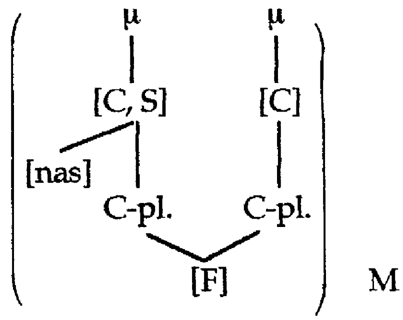
4. The representation of complex segments

The inadequate representation of glides found in Hyman (1985) is revised employing Clements's (1991a) proposal; namely the incorporation of the V-place node under the C-place node. Under his proposal, an underlying labialized and velarized or palatalized consonant is represented by a single root node, while I posit that a derived one involves two root nodes associated with distinct morae at the beginning stage of the phonology. However, they become one root node linked to one mora by undergoing CCF. Concerning the underlying representation of prenasalized obstruents, following the treatment of prenasalized consonants by Herbert (1986) and Hyman's (1985) 'Weight Theory', two components are posited and they are associated with distinct root nodes and with distinct morae underlyingly. This differs from the representation found in previous studies; viz., two root nodes associated with one mora underlyingly. In the course of syllabification the two morae are reduced to one; however, two root nodes are retained. Diagrams for an underlying consonant with secondary articulation and an underlying prenasalized obstruent displayed in (13) and (20a) in chapter 4 are repeated here as (2) and (3) respectively.

(2) C^{G}

(3) Underived ^{N}C





5. Lexical Phonology

In KiMvita, the ideas of Lexical Phonology are employed to analyze the occurrences of two sets of prefixes for vowel-initial stems in Cl. 1, 3, 4, 7, 8, and 15. On the basis of the occurrences of LDF or CCF, and the underived or the derived nature of forms, stems in various grammatical categories, noun prefixes, passive forms and causative forms are assigned to three levels in the lexicon. For example, two sets of prefixes of Cl. 7 and 8 for vowel-initial stems appear either at level 1 where the prefixes /tʃ-/ and /v^{y}-/ are seen or as the prefixes /ki-/ and /vi-/ are to be found at level 3. In Japanese, LP is employed to analyze vowel-initial morphemes. In the lexicon, an inherent root node is postulated for vowel-initial morphemes immediately preceded by a morpheme boundary, while an epenthetic glottal stop is considered for vowel-initial morphemes in the post-lexical phonology (see Japanese 6 below).

KiMvita

1. The revision of the inventory of consonant phonemes

On the basis of the pronunciation of Sh. Yahya, my informant, three phonemes are added to the inventory claimed by Yahya Ali Omar and Frankl (1997, 1998); they are /ŋ͡m^{w}/, found only in 'underived' items of Cl. 1 and 3, /f^{y}/ and /v^{y}/. Concerning the prenasalized obstruents, following

Herbert (1986), I have been considered it better to treat these as a sequence underlyingly, and as a unit at the surface level. This treatment fits very well into Hyman's 'Weight Theory', in which each segment is associated with its own mora at the very beginning of phonology. Therefore, a prenasalized obstruent's being a unit is derived as a result of syllabification. Prenasalized obstruents are not considered as phonemes, and thus, those prenasalized obstruent phonemes advocated by Yahya Ali Omar and Frankl are eliminated from the inventory. Consequently, a new phoneme /ᴺ/ as the archiphoneme expressing the nasal component of a prenasalized obstruent is proposed. Finally, in connection with the treatment of prenasalized obstruents, the revised inventory of consonant phonemes dispenses with two series of voiced stops, implosive and plosive (as when found in components of prenasalized stops or post-vocalic ('coda') stops). As a result, only one series of voiced stops /b, d, ɟ, g/ is proposed. Implosiveness or plosiveness is assigned by rules assigning airstream mechanism features in the Phonetic Component.

2. **The inventory of syllables**

This thesis refutes the (usual) claim that Swahili requires only a monomoraic (light) syllable (see Park 1995, 1997), and proposes that KiMvita requires bimoraic syllables as well as monomoraic syllables. Equipped with these two syllable types, two phonological phenomena are accounted for in a more elegant manner. Firstly, the distinction of voiced stop consonants which are phonetically realized as either implosive or plosive is analyzed employing a bimoraic syllable; the former is found in a voiced stop consonant which is exclusive to an onset position, while the latter occurs in a post-vocalic ('coda') position. Secondly, as a stress language, stressed segment lengthening occurs; however, the degree of such lengthening differs among segments depending on which syllable type a stressed segment belongs to. In other words, a stressed segment in a monomoraic syllable exhibits phonological lengthening, which is manifested by obtaining another mora; i.e., becoming a bimoraic syllable. On the other hand, a stressed segment in a bimoraic syllable, regardless of its position in a syllable, may not undergo such phonological lengthening, since such a syllable already contains two morae; phonological lengthening would create a trimoraic syllable, which does not exist in KiMvita. Regarding phonetic lengthening, stressed segments in both monomoraic and bimoraic syllables show lengthening although the degree of lengthening differs depending on the syllable type (see Appendices A and B for details).

3. **The stress bearer and the stress assignment**

This thesis proposes that the stress bearer is the mora, not the syllable as has been claimed in previous studies. The discussion of stress assignment reveals that stress placement is counted only by morae, and the stress is borne by the penultimate mora (not the penultimate syllable) associated either with a vowel or with a labial nasal or with /N-/, regardless of its position in a syllable, i.e., the first mora or the second mora. When the penultimate mora is associated either with an obstruent, with a liquid or with an alveolar nasal, stress shifts to its left. The same rule can be applied to Standard Swahili with one exception; a labial moraic nasal (and possibly /N-/ in a certain environment) optionally induces stress shift.

4. **Two types of nasals in N+C sequences**

The realization of N+C sequences is twofold in KiMvita; a nasal appears either to be a moraic nasal or to be a nasal component of a prenasalized obstruent. The two types of nasal are differentiated by feature organizations. While a moraic nasal is fully specified, a component of a prenasalized obstruent is only partially specified. In the latter, a place feature is not specified and it is provided by feature spreading from the following obstruent, i.e., Feature Linkage (FL) is seen between two segments. FL is inherently provided for underlying prenasalized obstruents, whereas it is derived when the two segments meet at a morpheme boundary. FL plays important roles in syllabification and Airstream mechanism assignment.

5. **The syllabification of two types of N**

Regarding the syllabification of prenasalized obstruents, a sequence of N+C undergoes the OCR and the OAR so that it comes to be realized as a unit on the surface; FL and the Minimal Word Size Constraint, i.e., two morae, allow the OAR to take place in such a sequence. In other words, if a word contains only two morae, the OAR does not apply, even if FL is found. Concerning the case of a moraic nasal, when it appears word-initially it remains unsyllabified since the LSC is not fulfilled, whereas when it appears word/phrase-internally it is realized as the second mora of the preceding syllable unless it is bimoraic; if the preceding syllable is already bimoraic, such a moraic nasal remains unsyllabified. These considerations are also true in the case of vowel-initial morphemes. Syllabification similar to that of moraic nasals is also applicable in the case of other moraic obstruents.

6. **Two types of glide in C+G sequences**

   Two types of high vocoid (glide) in C+G sequences are seen: (i) a glide as a component of a complex consonant; (ii) a glide as a component of a complex nucleus, i.e., a light diphthong. A glide in all C+G sequences, except for /ny/, /fy/ and /vy/, is regarded as a component of a light diphthong, while the three exceptions are regarded as phonemes. The two types of realization of glide require distinct underlying representations and syllabification-related processes.

7. **The syllabification of the two types of glide**

   Complex Consonant Formation (CCF) and Light Diphthong Formation (LDF) are advanced for the syllabification of two types of glide as stated in 6. Following Clements's (1991a) idea of incorporation of the V-place node under the C-place node, in CCF the [S] segment is incorporated under the [C, (S)] segment as the result of the deletion of the root node [S]. LDF involves adjunction of the [S]-[high] segment to the [S] segment to its right; this process occurs at the segmental level, but the mora level is not involved.

Japanese

1. **The accent bearer**

   In previous studies, most phonologists of Japanese, at least except for Yoshiba (1983), claim that the accent bearer is the syllable. This thesis proposes that the mora is the accent bearer because of: (i) the phonetic manifestation of accent; (ii) the Pre-*no* Deaccenting phenomenon. These are better analyzed employing morae as the accent bearers. Firstly, if the accent bearer is the syllable, the phonetic manifestation of accent (i.e., the sudden drop in pitch) requires a plausible explanation whenever the accent is borne by the first mora of a bimoraic syllable. Here the pitch change is obviously realized between the first and the second morae, though not across a syllable boundary. On the other hand, if the accent bearer is the mora then the phonetic manifestation of accent and the location of phonological accent can coincide. Thus, the sudden drop in pitch appearing between the first and the second morae of a bimoraic syllable is accounted for in a very clear cut manner. Secondly, concerning the Pre-*no* Deaccenting phenomenon, it is better to make a generalization referring to morae rather than syllables. Poser (1984) provides examples which do not accord with this rule, when it refers to the syllable as the accent bearer. There are further examples, provided by the present author, which benefit from the new analysis in which the accent is borne by the mora.

2. **The Second Mora Condition (SMC)**

In Japanese, in a post-vocalic ('coda') position, not only do nasals and the moraic components of geminate consonants (*k, s, t* or *p*) occur, but also the components of long vowels or vowel sequences. The SMC limits the association of the second mora to those segments. Thus, the SMC can capture a wider range of segments and can be stated in a simpler manner than Itô's Coda Condition, though the two conditions are not mutually compatible. In accordance with the SMC, segments listed in the condition do not undergo the Margin Creation Rule.

3. **The Moraic Consonant Constraint (MCC)**

A peculiarity of moraic consonants in Japanese is dependence on the preceding vowel without there being any intervening segment. This means that such a sequence of vowel and moraic consonant must be found in the same syllable. This is expressed by the MCC: a moraic consonant should not be (the nucleus of) the first mora. Thus a trimoraic sequence CVNÇ may not be syllabified as CV.NÇ; such a syllabification violates both the MCC and the LSC. (Note that in such a sequence a Ç is not immediately preceded by a vowel.) Consequently, only a trimoraic syllable is available for the syllabification of a sequence of CVNÇ; however, such a sequence is regarded as marked.

4. **The retention of moraicity for Ns throughout phonology**

Moraic nasals can never be realized as (the nucleus of) the first mora. This is proved by the syllabification of a sequence of CVNV, in which the second V is at a morpheme boundary. Since the second V does not have an onset, the N might be considered to be an onset to such a vowel, which would imply resyllabification. However, the inherent root node posited in the lexicon for S-J vowel-initial morphemes that do not occur as the first morpheme of a S-J compound plays the role of an onset. Therefore, the N is prevented from becoming an onset to the second V, and the moraicity of the N, present at the very beginning of phonology, is never lost.

5. **A trimoraic sequence and the revised Accent Bearer Constraint (ABC)**

   Trimoraic sequences are found in S-J compounds, loanwords, compounds and past tense verb forms. Usually those sequences in S-J compounds and loanwords are broken down into a monomoraic syllable followed by a bimoraic syllable. However, certain trimoraic sequences found in compounds and past tense verb forms, such as *roNdoNkko* 'Londoner', *tootta* 'passed' and so on, cannot be syllabified in such a way under the moraic theory employed here, because there is no potential onset for a bimoraic syllable. Moreover, the MCC must also be respected. Thus a trimoraic syllable is hypothesized for such sequences, as in the traditional analysis. However, a problem arises when the accent is assigned to the second mora of such a trimoraic syllable, for it violates the ABC, which states that the second mora may not bear the accent. This is maintained however by revising the ABC to the formulation where the last mora of a syllable may not bear the accent. This revised ABC enables us to recognize a trimoraic syllable type; however, this has to be regarded as special.

6. **The role of inherent root nodes and epenthetic glottal stops**

   An inherent root node is considered for S-J compounds or compounds in general involving a vowel-initial morpheme which only follows a morpheme boundary in the lexicon. However, a vowel-initial morpheme gets an epenthetic glottal stop in the post-lexical phonology. The two entities play the role as onsets to the following vowel. Thus, a word *eki -iN* 'station staff', for example, is syllabified as {?}e.ki.[RN]iN. Moreover, an inherent root node is considered for the case in which the second mora of a vowel sequence bears accent, e.g., $a\overset{*}{o}$*-i* 'blue-adj. formative' or $i\overset{*}{e}$ 'house' is syllabified as {?}a.[RN]$\overset{*}{o}$i or {?}i.[RN]$\overset{*}{e}$.

A Comparison between KiMvita and Japanese

1. **Two types of moraic nasals**

   As can be seen from the MCC in Japanese, moraic nasals in Japanese can be called 'dependent moraic nasals' because of their characteristic of being dependent on the preceding vowel, and thus they may not constitute a syllable independently from the preceding vowel. On the other hand, moraic nasals in KiMvita do not require such vowels, and so they may stand alone, i.e., they may remain unsyllabified, and therefore, they can be termed 'independent moraic nasals'. These terms could also refer to other moraic consonants in each language, thus in general, Japanese contains 'dependent moraic consonants' whereas 'independent moraic consonants' are found in KiMvita. For example, in the KiMvita phrase /si - taki/ → /[s̩]taki/ 'I don't want', /s/ of /si/ as a result of the vowel /i/ dropping comes to be realized as moraic, and it may remain unsyllabified, unless it is preceded by a monomoraic syllable.

2. **The status of the second mora in a bimoraic syllable**

   In this study, it has been found that while the second mora of a bimoraic syllable may bear stress unless it is associated with a segment that is not allowed as a stress bearer in KiMvita, it may not bear accent (at least in unmarked cases) in Japanese. The difference in the status of the second mora of a bimoraic syllable between the two languages investigated here was proved by the phonetic reality, i.e., the duration (see Appendix F).

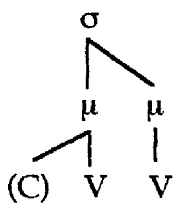
3. **A biphonemic representation for long vowels**

   In both KiMvita and Japanese, there is phonetic distinction between long and short vowels; a long vowel is regarded as a bisegmental sequence like any other kind of vowel sequence such as *ai*, *ie*, *uo*, etc. Language games can provide some of evidence that a long vowel is bisegmental in each language. In KiMvita, according to Park's (1997) study on Swahili, a long vowel is broken up by the prefix *cha*, which is affixed to each segment; e.g., kaa 'crab'[1] → cha-ka-cha-a, although my informant seems not familiar with such a game. In Japanese, the language game, the so-called *babibu* language, provides evidence. In this language, a syllable letter either *ba*, *bi*, *bu*, *be*, or *bo* is inserted after a targeted syllable depending on its vowel; e.g., *sakura* 'cherry blossom' → sa-ba-ku-bu-ra-ba, *okaasaN* 'mother' → o-bo-<u>ka</u>-ba-<u>a</u>-ba-sa-ba-N-bu, and so on. Representation of a long vowel is therefore depicted as in (4).

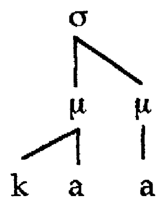
[1] See footnote 27 in chapter 4.

(4)

a.



b.



Appendices
Phonetic Experiments

Introduction

The treatment of the time-unit by the Rhythmici during the Greek period suggested the intriguing idea of assigning some phonological length to all the segments in a syllable in determining syllable quantity. However, as may already be apparent, this might not really be practical, because phonological length is really an abstract notion, which is not straightforwardly relatable to phonetic duration. In the literature, we can find that some experiments reveal a correlation between segment duration and phonological weight; a difference between light and heavy syllables reported by Duanmu (1994); a difference between moraic and nonmoraic codas found in a work done by Broselow, Chen, and Huffman (1997). On the other hand, Goedemans (1998) states that there is no evidence to be found in speech production for onset weightlessness. I believe however that it is worth exploring the extent to which phonetic reality, i.e., duration, corresponds to phonological weight in KiMvita and Japanese. In particular, the status of the second mora is of prime interest, which stems from the fact that the second mora may bear stress in KiMvita while the second mora (in unmarked cases) may not bear accent in Japanese.

With this prime concern in mind, the experiments involving KiMvita concern the following two points: (i) lengthening of the stressed segment in monomoraic and bimoraic syllables; (ii) the ratio of a consonant to a high vocoid (interpreted as 'glide (G)') in C+G sequences in specific environments based on stressed vowel location, i.e., a target sequence is immediately preceded by a stressed vowel or not.[1] The first experiment could provide evidence as to why the second mora associated with a labial nasal may be a stress bearer - whereas as we shall find it may not do so in Japanese. Moreover, comparison of stressed segment lengthening in a bimoraic syllable with that in a monomoraic syllable will provide a piece of evidence for recognizing that KiMvita requires bimoraic syllables. Concerning point (ii), we could assume a difference in ratio in such specific environments; the smallest ratio could be

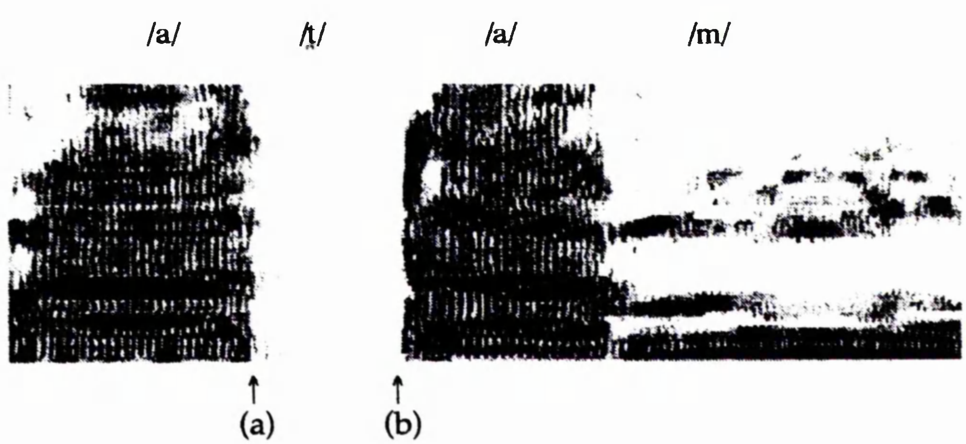
[1] Note that the term 'glide' is used as shorthand for 'high vocoid' (see 1.2.4.3.2), and such an alternative is used throughout the appendices.

expected when a C+G sequence is immediately preceded by a stressed vowel, thus being associated with a pronunciation of the secondary articulation type. In the case of Japanese, the following two points are examined: (i) the duration of segments and syllables; (ii) the lengthening of the accented second segment. Point (i) could also provide a reason for why the Rhythmici's application of phonological unit to each segment did not result in the ratio of a monomoraic syllable to a bimoraic syllable being 1 : 2. The second point might have a bearing on whether or not the accented second mora could constitute an independent syllable. However, the experiments carried out for this thesis are still in a pilot stage; the experiments were not systematically organized and provide some rather broad results, and they are not statistically consulted. Therefore, although some of results might provide supporting evidence for phonological phenomena, they still call for further research.

Technique

Spectrography has been chosen for the experiments described above. Spectrography is a device that translates a sound into a visual representation of its component frequencies. Each segment is distinguished by a characteristic enhancement of certain frequencies; i.e., formants. Vowels are largely distinguished by two characteristic formants, for example, the formants of the vowel schwa [ə] of the average male occur at 500 Hertz (Hz) and 1,500 Hz for the first and the second formants respectively. Stop consonants, on the other hand, present a blank space, or closure time, found between (a), offset of voicing of a preceding vowel, and (b), the release of a stop consonant appearing as a spike in a spectrogram. A part of a sentence /nasem**a** **t̪am**ka/ 'I say <u>tamka</u>' is shown in (1).

(1)



The duration of stop consonants corresponds to the closure time. The measurement of the duration of the vowel is taken as beginning at the point of the centre of the releasing spike of a preceding stop (see Peterson and Lehiste, 1960: 192-193, 200). In the case of aspirated stops, which contrast with unaspirated stops in KiMvita, the measurement of the duration of the vowel begins at the point where voicing starts. The duration of segments in both KiMvita and Japanese is measured in milliseconds.

Method

A spectrographic analysis based on a recording of listed test words was considered in each case. Each word was put in a carrier sentence, /nasema ____ / 'I say ___ ' for KiMvita, or *Watasi-wa* ____ *to itta.* 'I said ____ ' for Japanese. Each test word in its carrier sentence was read three times by native speakers. In KiMvita, the recording was made with Sh. Yahya, who is in his mid-late 70's and is thought to be one of the last generation of KiMvita speakers. Regarding Japanese, two native speakers, one female speaker in her thirties from Tokyo and one male speaker in his thirties from a central part of Japan, were chosen for recording. The male speaker's dialect does not affect the accent location of a word.

With regard to a method for the measurement of the duration of vowel sequences in the two languages, it might be assumed that the duration of a vowel sequence could not be measured in a straightforward way, since there is no clear partition between the two successive vowels. However, each vowel exhibits a steady state portion before or after the transition with the other vowel. Therefore, the following method was employed. The duration of the steady state portion of each vowel was measured, and the portion between them was regarded as the duration of the transition. This method, of course, cannot provide a clear figure for the duration of each vowel. Nevertheless, the duration of the steady state portions might highlight some characteristics of the difference between the first and the second morae, and between the stressed and the unstressed morae. Note that the first mora should be understood as being a non-branching mora, i.e., the duration of the first mora refers only to such a vowel throughout the Appendices. Note also that a diacritic ̣ under a segment, such as in ṃ or Ç, indicates moraic. Finally, the results are obtained on the basis of a calculation method which involves rounding up numbers of five and above, and rounding down under five.

Appendix A

KiMvita : Lengthening of the stressed segment in monomoraic syllables

On the basis of the pronunciation of Sh. Yahya, it could be hypothesized that the stressed segment in a monomoraic syllable gets lengthened more significantly than its counterpart in a bimoraic syllable.

1. The test words

(1) Unstressed / stressed vowel in a monomoraic syllable

/[ta]^{N}baza/	'drag on the ground'
/[ta]^{N}dua/	'unfurnishing a bed'
/[ta]^{N}gaza/	'make known'
/[tá]^{N}ba/	'walk slowly'
/[tá]^{N}da/	'spread'
/[tá]^{N}ga/	'sail'

2. The results and observations

The results of the duration of unstressed and stressed vowels in a monomoraic syllable were obtained from 18 occurrences; three tokens per word. The ratio of unstressed vowel [a] to stressed vowel [á] was obtained from nine occurrences of each. The resulting durations, and the ratio between them are shown in (2) and (3) respectively.

(2) The duration of unstressed and stressed vowels

	[C]	[a]		[C]	[á]
/[ta]^{N}baza/	64.8	164.4	/[tá]^{N}ba/	105.8	309.2
/[ta]^{N}dua/	66.4	177.3	/[tá]^{N}da/	95.9	340.6
/[ta]^{N}gaza/	67.4	145.8	/[tá]^{N}ga/	92.3	330.9
mean	66.2	162.5	mean	98.0	326.9

(duration in msec.)

(3) The ratio of [a] to [á]

	[a]		[á]
mean duration	162.5		326.9
ratio	1	:	2.01

(duration in msec.)

The following table shows the ratio between an unstressed syllable and a stressed syllable on the basis of measuring the entire duration of the syllable. The figures were based on the average duration of nine tokens of each syllable type.

(4) [Ca] vs. [Cá]

	[Ca]		[Cá]
mean duration	228.7		424.9
ratio	1	:	1.86

(duration in msec.)

The results show that a stressed vowel in a monomoraic syllable gets lengthened about 101% more than an unstressed vowel. On the other hand, the ratio of the stressed syllable to the unstressed syllable shows a slightly smaller figure; it is about 86% longer. Moreover, in a stressed syllable, not only the stressed segments but also the onset consonants exhibit longer duration than their unstressed counterparts.

Appendix B

KiMvita : Lengthening of the stressed segment in bimoraic syllables

The experiment designed here was to investigate whether or not stressed segment lengthening occurred in a phonologically bimoraic syllable, i.e., did it create a third mora? Various types of stressed segment in a bimoraic syllable were looked at: e.g., a stressed nasal, a stressed vowel associated with either the first or the second mora. Three types of bimoraic syllables, CVN̩, e.g., /[sam̩]li/, CV1V2 (V1≠V2), e.g., /[kai]d̪a/ or /pi[kia]/, and CVÇ, e.g., /[kab̥]la/, were considered. In accordance with the stress assignment rule in KiMvita (see 3.5), in the syllable types /Cam̩/ and /CVÇ/, the only possible stress bearer is the /m̩/ and the vowel respectively. However, two possible stress locations, either the first mora or the second mora, are available in syllables of the types /Cai/ and /Cia/.

Cam̩ syllables

1. The test words

The test words are shown in (1)

(1) Unstressed / stressed nasal in a bimoraic syllable /Cam̩/

/[t̪am̩]kia/	'pronounce for'
/[mam̩]laka/	'authority'
/[t̪ám̩]ka/	'pronounce'
/[sám̩]li/	'ghee'

2. The results and observations

The words given in (1) were examined to compare the duration of the second mora which is associated with a stressed nasal to that is associated with an unstressed nasal. Each word provided three occurrences, thus the ratio of the duration of the unstressed moraic nasal to that of the stressed moraic nasal was based on six occurrences each.

(2) Unstressed moraic nasal

	[C]	[a]	[m̩]
/[t̪am̩]kia/	80.2	95.3	164.6
/[mam̩]laka/	70.1	81.4	180.8
mean duration	75.2	88.4	172.7
ratio		1 :	1.95

(duration in msec.)

(3) Stressed moraic nasal[2]

	[C]	[a]	[ḿ̩]
/[t̪aḿ̩]ka/	70.5	148.3	292.2
/[saḿ̩]li/	114.7	158.3	288.3
mean duration	92.6	153.3	290.3
ratio		1 :	1.89

(duration in msec.)

(4) The ratio of [m̩] to [ḿ̩]

	[m̩]	[ḿ̩]
mean duration	172.7	290.3
ratio	1 :	1.68

(duration in msec.)

The results show that the stressed moraic nasal is about 68% longer than the unstressed moraic nasal. Moreover, the duration of the second mora whether associated with the unstressed nasal or with the stressed nasal is about twice as long as that of the first mora linked to the preceding vowel. This ratio is compared later with the results obtained from an experiment conducted on Japanese.

The results in (3) show that the stressed moraic nasal gets lengthened. However, compared with the stressed vowel lengthening seen in a monomoraic syllable (see Appendix A), the stressed moraic nasals in a bimoraic syllable exhibit much less lengthening. This is taken to suggest that the stressed moraic nasals do not get lengthened phonologically, i.e., they do not create another mora.

[2] The stressed moraic nasal is found not only in a labial nasal but also in other types of nasal, viz., the nasal prefix of Cl. 9/10 when it precedes a monomoraic stem, for example /N-ge/ [ŋ̩́ge] 'scorpion'. Such a stressed moraic nasal could be expected to exhibit stressed segment lengthening. This is revealed in results from a separate experiment; the duration of [ŋ̩́] was 249.6 (msec.), which is close to the figure obtained in (3).

Next, the whole duration of syllables is considered. On average, a syllable containing a stressed moraic nasal exhibits about a 59% increase in length when compared with a syllable containing an unstressed moraic nasal.

(5) [Cam̩] vs. [Caḿ̩]

	[Cam̩]		[Caḿ̩]
mean duration	336.3		536.2
ratio	1	:	1.59

(duration in msec.)

Cai / Ci̯a syllable

1. The test words

(6) Unstressed/stressed vowel in a bimoraic syllable /Cai/ or /Cia/

a. /ai/ /[t̪ai]reni/ 'a word cited to appease the spirit'
/[kai]mia/ 'continue to do something'
/[tʰái]/ 'eagle'
/[kái]/[3] 'personal name'
/[tʷaí]bu/[4] 'be well'
/[kaí]d̪a/ 'rule'

b. /ia/ /[kia]lio/ 'bit of stick put at the bottom of a pot'
/[zia]rani/ 'in the graveyard'
/pi[kía]/ 'cook for'
/bwa[kʰía]/ 'throw (food) into the mouth'
/[kiá]zi/ 'potato'
/[kiá]tu/ 'footwear'

2. The results and observations

The vowel sequences examined were /ai/ and /ia/ in three categories: (i) stressless [ai] and [ia]; (ii) stressed V1 [ái] and [ía]; (iii) stressed V2 [aí] and [iá].

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[3] This is usually preceded by /mwiɲi/ 'Mr.'. The word /kai/ does not mean 'give in' as found in Johnson (1939).

[4] Regarding /tʷ/, see 3.3.3.

The ratio of /a/ to /i/ was obtained by comparing the steady state portions of /a/ or /i/. The duration of each segment is given in (7) for /ai/ sequences and (8) for /ia/ sequences. The mean duration of each word was obtained from three tokens, and the ratio of each category was based on six tokens. In (7), the figure with * indicates that the duration of aspiration is not included in that of the following vowel. It should also be noted that the duration obtained from words containing the stressed first mora might not be entirely accurate, since the focused syllable appears word-finally, which always shows a longer duration than when it appears word-internally.

(7) /ai/ sequence: μ1μ2, μ́1μ2, μ1μ́2

		/ C/	/ a /	/ i /	/ai/	/ Cai /
μ1μ2	/[t̪ai]reni/	63.6	108.6	97.1	281.2	344.8
	/[kai]mia/	81.5	115.6	96.8	304.8	386.3
μ́1μ2	/[tʰái]/	82.3	216.8	153.0	640.6*	722.9
	/[kái]/	96.6	265.5	204.5	643.1	739.7
μ1μ́2	/[tʷaí]bu/	92.5	99.0	118.5	329.8	422.3
	/[kaí]d̪a/	79.9	119.3	165.2	376.0	455.9

(duration in msec.)

(8) /ia/ sequence: μ1μ2, μ́1μ2, μ1μ́2

		/ C/	/ i /	/ a /	/ia/	/ Cia /
μ1μ2	/[kia]lio/	74.7	80.8	99.8	287.2	361.9
	/[zia]rani/	105.5	92.3	92.4	253.9	359.4
μ́1μ2	/pi[kía]/	91.0	236.1	192.8	553.7	644.7
	/bwa[kʰía]/	44.6	233.9	174.7	626.3	670.9
μ1μ́2	/[kiá]zi/	66.3	136.3	181.3	477.1	543.4
	/[kiá]tu/	53.8	129.5	183.0	470.2	524.0

(duration in msec.)

In all cases, the stressed segments show a longer duration of steady state portion than their unstressed counterparts. Thus stressed vowel lengthening in a bimoraic syllable does in fact occur, although it is not clear how much the stressed vowel gets lengthened from consideration of the duration of the steady state portion itself.

As has been observed in the case of a stressed segment in a monomoraic syllable (see Appendix A), comparison of syllable duration between unstressed and stressed syllables might provide a clue as to how much a stressed segment gets lengthened. Table (9) shows the mean duration of each syllable and the ratio of unstressed syllables to stressed syllables, where the duration of the CV́V syllable was excluded since it appears word-finally, as mentioned above. The mean duration of the CVV syllable type and also that of the CVV́ syllable type were obtained on the basis of six tokens each.

(9) CVV vs. CVV́

		CVV	CVV́	ratio
mean duration	/Cai/	365.6	439.1	1 : 1.20
mean duration	/Cia/	360.7	533.7	1 : 1.48

(duration in msec.)

The results show that a CVV́ syllable is about 48% longer than a CVV syllable containing the sequence /ia/, while a CVV́ syllable is about 20% longer than a CVV syllable containing the sequence of /ai/.[5] Such a difference could be the result of inherent phonetic duration of low vs. high vowels. The fact that the duration of such syllables increases at most by 48% when a bimoraic syllable contains a stressed vowel is closer to the case of the stressed moraic nasal in a bimoraic syllable, which is 59%. Thus it could be said here again that the stressed segment lengthening takes place phonetically but it does not have clear phonological implications.

CVÇ syllable

1. The test words

(10) Unstressed/stressed vowels in a bimoraic syllable (CVÇ)

/[maṣ]kini/	'poor'
/[maʃ̣]taka/	'accusations'
/[káḅ]la/	'before'
/[kúf̣]ru/	'apostasy from Allah'

[5] The results obtained from CVV syllables were regardless of the type of consonant segment. However, even if the consonant is restricted to the same segment within paired syllables, little difference in the ratio is found. For example, syllables involving /kai/ provided the ratio of CVV : CVV́ as 1 : 1.20.

2. The results and observations

The test words did not have a consistent environment, however, this would not be expected to have a significant effect on the results. The results are given in (11) and (12). The mean duration was based on six tokens of unstressed/stressed vowels; three tokens from each word. The tables (13) and (14) provide the ratio of the stressed vowel to the unstressed vowel and that of the stressed syllable to the unstressed syllable respectively.

(11) Unstressed vowel in a CVÇsyllable

	C	V	Ç	ratio V : Ç
/[maș]kini/	55,2	77.7	91.4	1 : 1.18
/[maʃ]taka/	71.3	77.1	89.4	1 : 1.16
mean	63.3	77.4	90.4	1 : 1.17

(duration in msec.)

(12) Stressed vowel in a CV́Ç syllable

	C	V́	Ç	ratio V́ : Ç
/[káḅ]la/	67.4	113.6	98.2	1 : 0.86
/[kúf̣]ru/	58.1	115.7	112.9	1 : 0.98
mean	62.8	114.7	105.6	1 : 0.92

(duration in msec.)

(13) The ratio of [V] to [V́]

	[V]	[V́]
mean duration	77.4	114.7
ratio	1 :	1.48

(duration in msec.)

(14) [CVÇ] vs. [CV́Ç]

	[CVÇ]	[CV́Ç]
mean duration	231.1	283.1
ratio	1 :	1.23

(duration in msec.)

As can be seen in (13), the duration of the stressed vowel is about a 48% longer duration than its unstressed counterpart. However, this figure might not be entirely accurate because of the inconsistent environment. The unstressed vowels are preceded by nasal consonants while the stressed vowels follow stop consonants. Nevertheless, this result also supports the hypothesis that in a bimoraic syllable, phonological stressed segment lengthening does not take place, though the lengthening of the stressed segment occurs phonetically.

3. Summary

From the phonetic point of view, stressed segment lengthening occurs regardless of syllable type or of syllable quantity. In a monomoraic syllable, the stressed vowels appear more than twice as long as their unstressed counterparts (see Appendix A). In a bimoraic syllable, the stressed segments associated with the second mora exhibit at most a 68% longer duration than their unstressed counterparts, while the stressed segments associated with the first mora show approximately a 48% longer duration than their unstressed counterparts. The latter figure was obtained only from CVÇ syllables.

In addition, based on the results given in (2), (7), (8) and (11), the ratio of unstressed first mora to unstressed second mora in each syllable type, obtained by six occurrences of each, is given in (15). Note that the ratios of μ1 to μ2 in /Cai/ and /Cia/ syllables resulted from measurement of the steady state portion.

(15) The ratio of μ1 to μ2

	μ1		μ2
CVN̩	1	:	1.95
Cai	1	:	0.87
Cia	1	:	1.11
CVÇ	1	:	1.17

From the ratio in (15), it can be observed that when the two moraic consonants, i.e., moraic nasals and moraic obstruents, are compared, the status of the second mora as the stress bearer seems to correlate with the duration of the constituent segments to some extent.

Appendix C

KiMvita : C+G sequences

As I have discussed in chapter 3, a C+G sequence is perceptually realized as the Secondary Articulation (SA) type when a stressed vowel immediately precedes it, but as the Light Diphthong (LD) type when it appears elsewhere. In the experiment the latter category is subdivided into two specific environments; a C+G sequence in a stressed syllable and a C+G sequence in an unstressed syllable. Thus a C+G sequence is examined in three types of environment: (i) ... CV́CGV; (ii) ... CGV́CV; (iii) ... CGVCV... .

1. The test words

Words containing /mw/, /tw/, /kw/, /my/, /fy/, and /vy/ in the three specified environments were chosen, as in (1). In order to compare such sequences, including newly established phonemes /f^y/ and /v^y/, with /ny/ (an underlying phoneme), words involving /ny/ were also included, as in (2). Examples in (1a) are C+G sequences immediately preceded by a stressed vowel, while those given in (1b, c) are not found in such an environment. In (1b), a glide appears in a stressed syllable whereas a glide appears in an unstressed syllable in (1c). This is to see whether or not there is any stressed syllable effect.

(1)

	a. V́CG	b. ...CGV́CV	c. ... CGV...
/mw/	/ṭá[m^w]a/	/[mŭ]áo/	/[mŭ]a^{N}báo/
	'be left'	'confrontation'	'coast line'
/tw/	/pá[t^w]a/	/[tŭ]áza/	/[tŭ]alíwa/
	'eclipse'	'be proud'	'be seized'
/kw/	/pá[k^w]a/	/[kŭ]áta/[6]	/[kuă]ɟúka/
	'be painted'	'by foot'	'lose colour'
/my/	/kɨ́[m^j]a/	/[mĭ]áka/	/[mĭ]aɴbáni/
	'silence'	'years'	'at the rocks'
/fy/	/bó[f^j]a/	/[fĭ]áta/[7]	/[fĭ]atápo/
	'cause to press a soft surface such as fruit'	'hold down'	'when (I) hold down'
/vy/	/ná[v^j]a/	/[vĭ]áza/	/[vĭ]azápo/
	'cause to wash the hands'	'bring a new idea from the original'	'when (I) bring a ...'

(2)

	a. V́CG	b. ...CGV́CV
/ny/	/fá[ɲ]a/	/ku[ɲ]áta/
	'do, cause to do'	'shrink (into oneself)'
	/ɲá[ɲ]a]	/[ɲ]áɲa/
	'tomato, grandmother'	'tomato, grandmother'

2. The results and observations

With respect to the measurement of the duration of a glide, the same method used for measuring vowel sequence, described above, was employed and the steady state portion of a glide was measured. Since a glide always precedes a vowel, there is no clear partition between the glide and the following vowel. The results are given in (3) and (4).

In (3), the C+G sequences, except for /fy/ and /vy/ which are treated as the newly acquired phonemes (see 3.3.2.5.4), are regarded as sequences, not phonemes. The result is compared across the three specific environments: (i) a C+G sequence is immediately preceded by a stressed vowel; (ii) a C+G sequence appears in a stressed syllable; (iii) a C+G sequence appears in an

[6] This word is used in a phrase such as /piga kwata/ 'kick by foot/feet (when one is lying down)'.

[7] In Johnson (1939), this word has a meaning of 'hold between the legs'.

unstressed syllable. The mean duration of each segment in each word was based on three tokens, thus eighteen tokens were employed in the establishing the mean of C+G sequences in the three specific environments.

(3) Duration of the consonants and the following glides

		/C/	/G/	ratio
/mw/	/t̪á[mʷ]a/	92.7	20.2	1 : 0.22
	/[mŭ]áo/	89.9	23.7	1 : 0.26
	/[mŭ]aᴺbáo/	69.2	17.2	1 : 0.25
/tw/	/pá[tʷ]a/	66.5	26.1	1 : 0.39
	/[tŭ]áza/	64.9	30.0	1 : 0.46
	/[tŭ]alíwa/	55.2	24.3	1 : 0.44
/kw/	/pá[kʷ]a/	87.0	28.1	1 : 0.32
	/[kŭ]áta/	92.9	34.3	1 : 0.37
	/[kŭ]aɟúka/	69.9	24.4	1 : 0.35
/my/	/kí[mʲ]a/	103.1	49.2	1 : 0.48
	/[mĭ]áka/	101.3	52.7	1 : 0.52
	/[mĭ]aᴺbáni/	82.6	41.6	1 : 0.50
/fy/	/bó[fʲ]a/	143.0	51.0	1 : 0.36
	/[fĭ]áta/	117.4	52.5	1 : 0.45
	/[fĭ]atápo/	92.9	37.4	1 : 0.40
/vy/	/ná[vʲ]a/	83.4	34.8	1 : 0.42
	/[vĭ]áza/	84.0	49.1	1 : 0.58
	/[vĭ]azápo/	76.0	36.1	1 : 0.48
V́CG (mean)		96.0	34.9	1 : 0.36
CGV́ (mean)		91.7	40.4	1 : 0.44
CGV⁽ᴺ⁾CV́CV (mean)		74.3	30.2	1 : 0.41

(duration in msec.)

As can be seen in (3), the duration of the glides themselves does not, in fact, show a significant difference within each group of words, however, when the ratio of the consonant to the glide is compared, a difference is seen. On the whole, C+G sequences in the environments (ii) and (iii) exhibit a larger ratio than those in the environment (i). In (3), a glide immediately preceded by a stressed vowel shows 4% - 16% (mean 8%) or 2% - 6% (mean 5%) reduction in duration than a glide in the environments (ii) or (iii). The biggest ratio is found when a C+G sequence is immediately followed by a stressed vowel, i.e., when it is in a stressed syllable. A stressed syllable might cause such a result: it is generally said that a stressed syllable exhibits a longer duration than an unstressed syllable and that the duration of each segment in a syllable is affected by this (see Laver 1994: 448). Regarding a C+G sequence in environments other than these, it could be expected that the ratio in such an environment is closer to that found in a stressed syllable. Although some sequences meet this expectation, others do not. Concerning the /mw/ sequence, three different environments, based on the location of the stressed vowel, seem to show the difference to a lesser degree. This might be because of their sharing the same articulator, labial. However, in all cases, the smallest ratio is found when a C+G sequence is immediately preceded by a stressed vowel. This fact probably creates the perceptual difference; the smallest ratio of a consonant to a glide corresponds to the SA type pronunciation, whereas the larger ratio of a consonant to a glide corresponds to a phonetic realization of the LD type.

Table (4) displays the result of a similar measurement of /ny/, which is universally regarded by Swahilists as an underlying phoneme. As can be seen in (4), the location of the stressed vowel affects the /ny/ sequences fairly insignificantly, as in the case of the /mw/ sequence. This could also be related to the correlation seen with regard to the same feature, [coronal], being shared by the [n] and the [j] components. The results were obtained from twelve tokens of C and G; three tokens of each word. In this experiment, only two specific environments, i.e., (i) and (ii) as stated above, were considered.

(4) The duration and the ratio of /ny/ sequence

	/C/	/G/	ratio
/fá[ɲ]a/	75.0	22.0	1 : 0.29
/ɲá[ɲ]a/	76.5	20.6	1 : 0.27
/ku[ɲ]áta/	67.3	20.2	1 : 0.30
/[ɲ]áɲa/	73.6	20.0	1 : 0.27
V́CG (mean)	75.8	21.3	1 : 0.28
CGV́ (mean)	70.5	20.1	1 : 0.29

(duration in msec.)

3. Summary

The ratio of the duration of a consonant to a glide as between the three particular environments seems to correlate with a perceived difference in pronunciation of C+G sequences. Regarding the C+G sequences (except for the /ny/ sequences), based on the mean ratio, a C+G sequence in the environments (ii) or (iii) are respectively 8% or 5% bigger than the ratio seen in (i), and a 3% difference in the ratio is found between the environments (ii) and (iii). The smallest ratio, obtained when a C+G sequence is immediately preceded by a stressed vowel, probably explains the perceived pronunciation of these as of the SA type. On the other hand, the biggest ratio found in a C+G sequence appearing in a stressed syllable could well correspond to the perceived pronunciation of this as the LD type. No such differences are found in the /ny/ sequences, and they are moreover quite minimal in /mw/ sequences.

Appendix D

Japanese : Duration of segments and syllables in unmarked syllables

Measurement of the duration of each segment in monomoraic and bimoraic syllables was conducted first. In the bimoraic syllables, comparison of the ratio of the first mora to the second mora was made. Finally, comparison of a monomoraic syllable to a bimoraic syllable was considered.

1 The test words

The test words were chosen from among words containing one of the consonants *p, t, s, k, m* or *n* which was preceded and followed by the vowel *a*. However, some of the test words could not fully meet this requirement. The test words have a HL... tonal pattern.[8] The test words are shown in (1) and (2), where the consonant in slash brackets is the target segment for a single vs. geminate contrast, but it is not necessary that the same segment be the onset consonant of a syllable in each case. Bimoraic syllable types are CVN, CVÇ, and CVV ($V_1=V_2$, $V_1 \neq V_2$). A geminate consonant is conventionally transcribed using two identical phonemes, and the leftmost of these is understood as moraic.

[8] In the literature, it is said that accent is not a primary factor for segmental lengthening, although accented segments show the longer duration (but small) than their unaccented counterparts (see Sugito and Mitsuya 1977:11). Hoequist (1983: 210) reports that in Japanese, the average duration ratio of accented to unaccented syllables is 1.02 : 1. This could be interpreted as saying that the duration of a segment should not be affected by tonal difference.

(1) Onset consonants, geminate consonants, moraic nasals[9]

/p/	papa	'father/dad'	/s/	kasa	'umbrella'
	kappa	'proclaim'		hassai	'eight years old'
	kaNpa	'cold wave'		kaNsai	'western part of Japan'
	popai	'Popeye'		Kasai	'surname'
/t/	hata	'field/farm'	/m/	rama	'lama'
	hatta	'crawl - past tense'		raNma	'entangled matters'
	haNta	'personal name'		yamai	illness'
	yatai	'stall'			
/k/	saka	'tea and sweet'	/n/	kana	'personal name'
	sakka	'last summer'		kaNnai	'inside the building'
	saNka	'song of praise'		kanai	'my wife, one's family'
	Sakai	'place name'			

(2) Short vs. long vowels

/p/	kappa	'proclaim'	tappaa	'Tupperware'
/t/	kata	'shoulder'	kaataa	'Carter'
/k/	maka	'superior (Buddhism)'	maakaa	'marker'
/s/	kasa	'umbrella'	kaasaa	'cursor'
/m/	samarii	'summary'	samaa	'summer'
/n/	mana	'a type of vegetable'	manaa	'manner'

2 The results and observations

Based on the duration of segments, the following comparisons are made: (a) that of a short vowel in a monomoraic syllable vs. one in a bimoraic syllable; (b) of an onset consonant in a monomoraic syllable vs. that in a bimoraic syllable; (c) of a short vowel in a bimoraic syllable vs. some other segment linked to $\mu 2$; (d) of a monomoraic syllable vs. a bimoraic syllable measured overall.

2. 1 Duration of segment

The mean duration and the ratio are given in (3). The assumed duration of the moraic part of a geminate consonant was obtained by subtracting the duration of a single consonant from that of a geminate consonant;

[9] In spelling of the words *raNma* and *kaNnai*, *N* is used instead of *m* and *n* respectively in accordance with the Second Mora Condition proposed in 5.3.2.1.

schematically, ÇC-C = Ç. With respect to the duration of the second mora part of a long vowel, the same method was also employed. As will be found shortly, the duration of a short vowel in a bimoraic syllable is longer than that found in a monomoraic syllable. Therefore, the duration of the second mora part of a long vowel will be calculated with reference to the duration of a short vowel in a bimoraic syllable. Regarding the duration of each segment in the vowel sequence *ai*, this was obtained by measurement of the duration of the steady state portion in each segment. The results of CaN, CaÇ and Cai syllables were based on 12, 18 and 27 occurrences respectively uttered by each speaker; two words *raNma* and *kaNnai* were excluded from the result for CaN syllables.[10] In the case of Ca and Caa syllables, only the examples in (2) were considered. The data relating to onset consonants was based on the analysis of 15 occurrences, except for the consonant *p*, and measurements of short and long vowels were based on 18 occurrences each from each speaker.

(3)

	Speaker 1				Speaker 2			
	C	μ1	μ2	total	C	μ1	μ2	total
Ca	57.1	81.0	—	138.1	71.3	98.6	—	169.9
Caa	79.5	152.2		231.7	91.9	191.2		283.1
CaN	85.7	96.8	63.7	246.2	118.8	121.2	102.6	342.6
CaÇ	79.7	82.1	112.1	273.9	113.6	100.3	125.7	339.6
Cai	68.2	54.1	35.5	224.1	76.9	58.1	43.1	257.5

	mean			
	C	μ1	μ2	total
Ca	64.2	89.8	—	154.0
Caa	85.7	171.7		257.4
CaN	102.3	109.0	83.2	294.5
CaÇ	96.7	91.2	118.9	306.8
Cai	72.6	56.1	39.3	240.8

(duration in msec.)

Two observations are made concerning the results shown in (3). Firstly, an onset consonant and a short vowel in a bimoraic syllable are consistently longer than those in a monomoraic syllable. The following table displays comparison of the vowel *a* in monomoraic and bimoraic syllables. The

[10] This is because both sequences phonetically manifest a geminate consonant, although representation of these words seems to imply a syllable containing a moraic nasal rather than a geminate consonant. Moreover, the Second Mora Condition requires such a representation.

duration of the vowel *a* followed by a moraic nasal is considered for the duration of a short vowel *a* in a bimoraic syllable, since in general it is said that a geminate consonant induces shortening of the preceding vowel. The results relating to short vowels and onset consonants in bimoraic syllables were obtained from 12 and 72 occurrences of each by each speaker, and those relating to short vowels and onset consonants in monomoraic syllables were based on 15 occurrences of each from each speaker.

(4) An onset consonant and a short vowel in two types of syllable

	C (mono)	C (bi)	a (mono)	a (bi)
Speaker 1	57.1	78.3	81.0	96.8
Speaker 2	71.3	100.3	98.6	121.2
mean duration	64.2	89.3	89.8	109.0
Speaker 1	1 :	1.37	1 :	1.20
Speaker 2	1 :	1.41	1 :	1.23
mean ratio	1 :	1.39	1 :	1.22

Based on these figures, the duration of the second mora part of a long vowel can be obtained by subtracting the duration of a short vowel found in a bimoraic syllable, CVN, from a long vowel. 18 tokens each were found from each speaker.

(5) The duration of μ1 and μ2 of a long vowel

	Speaker 1	Speaker 2	mean
aa	152.2	191.2	171.7
μ1 of aa	96.8	121.2	109.0
μ2 of aa	55.4	70.0	62.7

(duration in msec.)

Secondly, a short vowel *a* exhibits shorter duration when it is followed by the moraic part of a geminate consonant than when it is followed by the moraic nasal. This could accord with a general tendency in the relationship between a vowel and a following geminate consonant, viz., that when the vowel is followed by a geminate consonant, the vowel gets shortened. This could explain the difference in duration between the two types of moraic segment; as can be seen in (6), the duration of the moraic nasals is less than that of the preceding vowels whereas that of the moraic part of the geminate consonants is, on average, about 31% longer than that of the preceding vowels.

The table (6) displays the ratio of the first mora to all types of second mora and was obtained on the basis of the figures shown in (3) and (5).

(6) The ratio of the first mora to the second mora

	Speaker 1			Speaker 2			mean		
	μ1		μ2	μ1		μ2	μ1		μ2
aa	1	:	0.57	1	:	0.58	1	:	0.58
aN	1	:	0.66	1	:	0.85	1	:	0.76
aÇ	1	:	1.37	1	:	1. 25	1	:	1.31[11]
ai	1	:	0.66	1	:	0.74	1	:	0.70

The segments associated with the second mora, except for the moraic part of a geminate consonant, consistently show shorter duration than the short vowel *a* linked to the first mora.

2. 2 Monomoraic syllables vs. bimoraic syllables

The duration of monomoraic and bimoraic syllables and the ratio of the monomoraic syllables to the bimoraic syllables based on the data obtained in the previous section are given in (7).

(7)

	Ca		Caa		CaN		CaÇ		Cai
Speaker 1	138.1		231.7		246.2		273.9		224.1
Speaker 2	169.9		283.1		342.6		339.6		257.5
mean duration	154.0		257.4		294.5		306.8		240.8
Speaker 1	1	:	1.68	:	1.78	:	1.98	:	1.62
Speaker 2	1	:	1.67	:	2.02	:	2.00	:	1.52
mean ratio	1	:	1.68	:	1.90	:	1.99	:	1.56

(duration in msec.)

The mean ratio of a monomoraic syllable to a bimoraic syllable is 1 to 1.56 ~ 1.99 (mean 1.78) depending on the segment types in the bimoraic syllable. When the mean ratio of monomoraic syllable to bimoraic syllables is compared with the one spoken about by the Rhythmici, i.e., 1 to 1.67, the result obtained here, 1 to 1.78, is rather closer to 1 to 2, which is the usual assumption

[11] The figure was calculated by the ratios from the two speakers, but not the mean duration of each segment (cf. (2) in Appendix F).

concerning the ratio of the length of monomoraic to bimoraic syllables. If only CaN and CaÇ syllable types are considered, the result, 1 to 1.90 ~ 1.99, is much closer to 1 : 2; though the ratio found in the Caa syllable type is almost the same as the one claimed by the Rhythmici, and the Cai syllable type shows a smaller ratio than that of the Rhythmici. However, on the whole, such a difference could arise if a uniform system of phonological length units is assigned to onset consonants or short vowels regardless of syllable weight which is what the Rhythmici did: they assigned 0.5 to an onset consonant, 1.0 to a short vowel and a post-vocalic ('coda') consonant, and 2.0 to a long vowel regardless of syllable type.

However, if the observations made above are taken into consideration, we need two sets of phonological length unit systems, because the ratio of an onset consonant in a monomoraic syllable to that in a bimoraic syllable could not be the same, as far as Japanese is concerned. As found in (4), the duration of an onset consonant in a bimoraic syllable is on average 39% longer than its counterpart in a monomoraic syllable. A short vowel in a bimoraic syllable shows 21% longer duration on average than its counterpart in a monomoraic syllable. Concerning the second mora, except for the moraic part of geminate consonant, the duration is 68% of the duration of a short vowel in a bimoraic syllable. If these facts are taken into consideration, the following calculations could be made. In (8), the figures with boldface show revised phonological length units for monomoraic and bimoraic syllables.

(8)

	monomoraic syllable	bimoraic syllable
C	1	1 x 1.39 = 1.39 → **1.5**
V (μ1)	2	2 x 1.21 = 2.42 → **2.5**
V/N (μ2)	—	2.5 x 0.68 = 1.70 → **2.0**

(8) does not give any figure for the moraic part of a geminate consonant. However, the figure 2.0, from the bimoraic syllable, could also be applicable to it, provided that length adjustment takes place between a short vowel and the moraic part of geminate consonant; thus, V (μ1) + C(μ2) = 4.5. In fact, when the ratio of μ1 (V) to μ2 (C), 1 to 1.31 (see (6) above), is converted to that of μ2 (C) to μ1 (V), it will be 1 to 0.76, which is exactly the same figure as the one obtained from μ1 (V) to μ2 (N). This fact could support length adjustment between a short vowel and the moraic part of a geminate consonant. Thus, the ratio of a monomoraic syllable to a bimoraic syllable is, now, 1+2 : 1.5+2.5+2 = 1 : 2. This is a phonological ratio, however, it is quite close to the ratio obtained from

measurements of the phonetic realization. These results might be typical for a language like Japanese, however, further research is strongly required so that a more firmer conclusion may be reached.

To sum up, an important finding here is that there are differences between monomoraic and bimoraic syllables in the duration of an onset consonant and a short vowel. This might suggest that we should investigate the possibility that the accented second mora constructs an independent syllable so that the constraint governing the accent bearer is fulfilled. The ratio of the first mora to the second mora suggests that an insightful comparison could be made between the second morae in KiMvita and those in Japanese (see Appendix F).

Appendix E

Japanese : The accented second mora in special cases

Regarding the status of the second mora, it is generally accepted that it may not bear accent in Japanese. However, in a very special case such as *roNdoNkko*, according to the traditional syllabification, the accent falls on a nasal which is associated with the second mora in a trimoraic syllable, viz., *doNk*. This is apparent because the accent does not shift to the vowel preceding the *N*. As a consequence, in the view of Kubozono (1995), the accented second mora needs to construct an independent syllable.

The special case in which the second mora comes to bear the accent was examined from two perspectives: one was to measure lengthening of the accented segment and the other to compare a CV sequence with one in a typical (unmarked) monomoraic/bimoraic syllable. The former investigation was to find whether an accented second mora, with which a nasal or a vowel is associated, gets lengthened enough to construct an independent syllable. The latter point was to see whether or not there was any change in duration of a CV sequence depending on the syllable type to which it belongs as a consequence of accent location; i.e., CV.N/VÇ vs. CVN/V, for example, roN.do.Nk.ko vs. roN.doN.ko (where . indicates a syllable boundary). The latter sequence was obtained by affixation of a *-ko* suffix. Such a pronunciation was the norm before 'roNdoNkko' started becoming acceptable, and it is still to some extent attested. If the N constructs an independent syllable, it could be predicted that each segment of CV of CVN/V would show a longer duration than in the case of CV in CV.N/VÇ.

1. The test words

In order to see accented segment lengthening, two accentuation patterns in the same word were examined. Words containing a word-final bimoraic syllable were affixed: (i) by a *-kko* suffix; (ii) by a *-ko* suffix. The test words are given in (1). Words containing a word-final long vowel, such as *tookyoo*, were excluded from this experiment. Two identical letters are used in the transcription of a geminate consonant with the leftmost element being understood as moraic.

(1) Accented vs. unaccented segments associated with the second mora

roNdo$\overset{*}{N}$kko	roNd$\overset{*}{o}$Nko	'Londoner'
okaasa$\overset{*}{N}$kko	okaas$\overset{*}{a}$Nko	'a person very closed to her/his mother'
toka$\overset{*}{i}$kko	tok$\overset{*}{a}$iko	'urbanite'
geNda$\overset{*}{i}$kko	geNd$\overset{*}{a}$iko	'a child of today'

2 The results and observations

The duration of an onset consonant, the accented first mora and the accented second mora are displayed in (2). The target sequences were CV_1V_2 ($V_1 \neq V_2$) and CVN, which were followed either by *-ko* or by *-kko.* When sequences are followed by *-ko,* the accent falls on V(1), but when it is followed by *-kko,* the accent falls either on the V2 or on the N. Hence, a $CV_1\overset{*}{V}_2Ç$ or a $CV\overset{*}{N}Ç$ sequence would be required to be syllabified as $CV_1.\overset{*}{V}_2Ç$ or $CV.\overset{*}{N}Ç$ under the Accent Bearer Constraint, viz., the second mora may not bear accent. In (2), the bold, underlined segments were the ones measured. Table (3) shows the mean of CVN sequences obtained from the two speakers, since CVV sequences involved the vowel sequence *ai* from which only the duration of the steady state portion could be obtained. However, the results obtained from words containing such sequences explicitly show lengthening of the accented second mora.

(2) a. Speaker 1

	[C	μ1]σ	$\overset{*}{\mu}$2	Ç	[C	$\overset{*}{\mu}$1	μ2]σ
roN**doN**(k)ko	35.1	98.1	83.7	156.3	38.3	103.5	70.2
okaa**saN**(k)ko	123.3	76.5	74.1	122.7	110.1	80.1	77.4
geN**dai**(k)ko	33.9	29.9	37.2	153.3	34.2	50.5	31.3
to**kai**(k)ko	72.9	45.2	38.0	162.6	68.6	51.2	27.3
mean (CVN)	79.2	87.3	78.9	139.5	74.2	91.8	73.8

(duration in msec.)

b. Speaker 2

	[C	μ1]σ	$\overset{*}{\mu}2$	Ç	[C	$\overset{*}{\mu}1$	μ2]σ
roN**doN**(k)ko	27.3	111.0	105.6	130.5	39.0	133.2	89.7
okaa**saN**(k)ko	94.5	102.9	91.2	171.6	101.7	109.8	92.1
geN**dai**(k)ko	24.3	62.5	45.2	139.2	27.0	76.7	39.8
to**kai**(k)ko	66.0	47.2	36.3	152.1	78.6	60.7	36.5
mean (CVN)	60.9	107.0	98.4	151.1	70.4	121.5	90.9

(duration in msec.)

c. durational increment of μ2

	Speaker 1	Speaker 2	mean
roN**doN**(k)ko	+ 13.5	+ 15.9	+ 14.7
okaa**saN**(k)ko	- 3.3	- 0.9	- 2.1
geN**dai**(k)ko	+ 5.9	+ 5.4	+ 5.7
to**kai**(k)ko	+ 10.7	- 0.2	+ 5.3
mean (CVN)	+ 5.1	+ 7.5	+ 6.3

(duration in msec.)

(3)

	[C	μ1]σ	$\overset{*}{\mu}2$	Ç	[C	$\overset{*}{\mu}1$	μ2]σ
mean (CVN)	70.1	97.2	88.7	145.3	72.3	106.7	82.4

(duration in msec.)

The following four comparisons are made based on the results obtained from CVN sequences in (3): (i) $\overset{*}{\mu}2$ vs. μ2 and $\overset{*}{\mu}2$ vs. $\overset{*}{\mu}1$; (ii) μ1 vs. $\overset{*}{\mu}1$; (iii) an onset consonant in monomoraic and bimoraic syllables; (iv) Cμ1 vs. C$\overset{*}{\mu}1$μ2. Comparison (i) was to see how much the accented second mora got lengthened and whether such lengthening was enough to construct an independent syllable. The comparisons (ii), (iii), and (iv) were to see whether the ratio between the two entities in each pair accorded with the one obtained from unmarked syllable types.

The ratio of $\overset{*}{\mu}2$ to μ2, and that of $\overset{*}{\mu}2$ to $\overset{*}{\mu}1$ are given in (4).

(4)

	$\overset{*}{\mu}2$		$\mu 2$	$\overset{*}{\mu}1$
mean duration	88.7		82.4	106.7
ratio	1.08	:	1	
	0.83		:	1

(duration in msec.)

The figures in (4) show that the accented second mora gets 8% longer duration than its unaccented counterpart; accented segment lengthening seems to occur. The comparison of $\overset{*}{\mu}2$ with $\overset{*}{\mu}1$ was to see whether duration of $\overset{*}{\mu}2$, which is associated with a nasal, was sufficient for it to be considered as being the first mora of an independent syllable. As the figure shows the duration of the accented second mora is about 83% of the first mora of a syllable $C\overset{*}{\mu}1\mu 2$. When inherent duration is taken into consideration, this accented second mora might well be regarded as the first mora of an independent syllable. Moreover, when the ratio of the first mora to the second mora in an unmarked CaN syllable type, 1 : 0.76 (see (6) Appendix D), is considered, the ratio 1 : 0.83 in *roNdoNkko* obtained here might be interpreted by saying that the accented second mora, which shows a slightly bigger figure than the unmarked syllable types, could be regarded as the first mora of another syllable.

The next comparison is made between the unaccented and the accented first morae; the former is found in a monomoraic syllable while the latter is found in a bimoraic syllable.

(5)

	$\mu 1$		$\overset{*}{\mu}1$
mean duration	97.2		106.7
ratio	1	:	1.10

(duration in msec.)

As would be expected, the first mora in a bimoraic syllable shows longer duration than that in a monomoraic syllable. The figure is rather closer to the one found in unmarked cases, which is 1 : 1.21 (see (4) in Appendix D). In terms of the ratio of the first mora to the second mora - see (i) and (4) - and the type of the first mora - see (ii) and (5), the result obtained here might support the possibility of the accented second mora constructing an independent syllable.

However, the following two comparisons seem not to support such a possibility. Two results, concerning onset consonants in two types of syllable and the duration of monomoraic and bimoraic syllables, are shown in (6). In the third row, the ratio obtained from unmarked cases are shown (see (4) and (7) in Appendix D).

(6)

	C (mono)		C (bi)	Cμ		$C\overset{*}{\mu}1\mu2$
mean duration	70.1		72.3	167.3		261.4
ratio	1	:	1.03	1	:	1.56
(unmarked)	1	:	1.39	1	:	1.91

(duration in msec.)

The ratio of an onset consonant in a monomoraic syllable to that in a bimoraic syllable is 1 : 1.03, which is a smaller ratio than that found in the unmarked cases. The same is true in the case of the two types of syllable. Neither comparison seems to support the possibility of the accented second mora constructing an independent syllable.

The implications of the four comparisons could be summarized as follows. As far as considerations of the first mora and the second mora are concerned, the results could suggest that it might be possible for the accented second mora to constitute an independent syllable. However, the small significance of the duration of the onset consonant between the two types of syllable and the ratio of a monomoraic syllable to a bimoraic syllable tends to disconfirm such an independent syllable hypothesis.

There might be an implication here that a syllable containing an accented second mora might constitute a trimoraic syllable, and the increase in the duration of the accented mora might be interpreted as a kind of lengthening adjustment between the first and the second morae, for example the durations of $\mu1\overset{*}{\mu}2$ and $\overset{*}{\mu}1\mu2$ are 185.9 and 189.1 (msec.) respectively. In addition, one more observation concerning the trimoraic syllable consideration could be made in connection with the moraic part of geminate consonants. The overall durations of trimoraic syllables in *roNdoNkko* and *okaasaNkko* might involve a slight shortening of the onset consonant and the first mora, and such shortening might be induced by the moraic part of geminate consonants. If a trimoraic syllable is an appropriate syllable type for such a trimoraic sequence, we might expect some temporal adjustment in such a marked case. Nevertheless, there is no doubt that the overall length of a trimoraic syllable is longer than any other syllable type. The following table shows the duration of trimoraic syllables obtained here, compared with the duration of monomoraic and bimoraic syllables in unmarked cases (see (7) in Appendix D). Moreover, phonological units considered in Appendix D (8) are applied to each syllable type; one set for the bimoraic syllable is applied to the trimoraic case here.

(7)

	CV		CVN		CV$\overset{*}{\text{N}}$Ç
mean duration	154.0		294.5		401.3
ratio	1	:	1.91	:	2.60
phonological unit	3		6		8
ratio	1	:	2	:	2.67

(duration in msec.)

The figures in (7) are interesting; the ratio obtained from the duration of each syllable and the phonological length units are very close each other. This might suggest that a trimoraic syllable is a more conceivable solution than that of an independent syllable of $\overset{*}{\text{N}}$Ç. However, this issue requires further research.

Appendix F

The second mora in KiMvita and Japanese

On the basis of the phonetic experiments carried out, a possibly insightful comparison could be made between KiMvita and Japanese concerning the difference in the status of the second mora: it may be the stress bearer in KiMvita while it may not be the accent bearer (except in marked cases) in Japanese. The figures for Japanese are the means of the results obtained from two speakers.

First of all, the ratio of the first mora to the second mora with which a nasal is associated is examined. The results are given in (1), which were based on the results given in (2) in Appendix B for KiMvita and (3) in Appendix D for Japanese. The second mora was not stressed or accented. In (1), μ2 may be associated either with a labial nasal in KiMvita or with any type of nasal in Japanese.

(1)

	μ1 : /a/	μ2 : /m/ or N	ratio
KiMvita	88.4	172.7	1 : 1.95
Japanese	109.0	83.2	1 : 0.76

(duration in msec.)

The figures in (1) show a notable difference in the duration of the second mora between the two languages. The ratio of the first mora to the second mora exhibited in KiMvita is more than twice that in Japanese.

Regarding the case of the second mora associated with an obstruent, the ratio of the first mora to the second mora does not show such a significant difference. Rather, the figures are close to each other in both languages, providing environment differences are not taken into consideration; the second mora is a part of a geminated consonant in Japanese while it is a component of a sequence in KiMvita. The results are shown in (2), which were based on the result given in (11) in Appendix B for KiMvita and (3) in Appendix D for Japanese.

(2)

	μ1 : /a/	μ2 : C	ratio
KiMvita	77.4	90.4	1 : 1.17
Japanese	91.2	118.9	1 : 1.30

(duration in msec.)

With regard to the vowel sequence /ai/, there is no considerable difference in the ratio between the two languages. In (3), the left-hand column shows the duration of the steady state portion in each segment, and the right-hand column shows the ratio of the first mora to the second mora. (See (7) in Appendix B for KiMvita and (3) and (6) in Appendix D for Japanese.)

(3)

	μ1 : /a/	μ2 : /i/	ratio
KiMvita	112.1	97.0	1 : 0.87
Japanese	56.1	39.3	1 : 0.70

(duration in msec.)

To sum up, the second mora is not always weaker than the first mora. It sometimes has the same prominence as the first mora. However, the status of the second mora really seems to depend on the segment type concerned and the language in question. In the case of KiMvita, the second mora associated with a nasal or a vowel behaves like the first mora, however an obstruent in the second mora does not do this as far as stress bearing is concerned. On the other hand, in Japanese, in general, the second mora, which may be associated with any kind of segment, does not play the role of accent bearer, which is usually played by the first mora in unmarked syllable types. These facts suggest that the differences in duration adduced here cannot constitute an explanation for all cases. Nevertheless, comparison of moraic nasals between KiMvita and Japanese does display a clear distinction. Thus it could be said that the phonetic evidence, i.e., the duration, certainly cannot provide an explanation for all the phonological phenomena discussed, though, to some extent, the phonetic evidence does.

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Abbreviations

BLS	Berkeley Linguistic Society
CLS	Chicago Linguistic Society
CUP	Cambridge University Press
LI	Linguistic Inquiry
MIT	Massachusetts Institute of Technology
OUP	Oxford University Press
SAL	Studies in African Linguistics
SOAS	School of Oriental and African Studies

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