

SYLLABLES and TEMPLATES:
EVIDENCE from SOUTHERN SIERRA MIWOK

by

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**Syllables and Templates:
Evidence from Southern Sierra Miwok**

by
Kelly Dawn Sloan

Submitted to the Department of Linguistics and Philosophy
on June 10, 1991 in partial fulfillment of the requirements
for the Degree of Doctor of Philosophy in Linguistics

ABSTRACT

This thesis examines aspects of the syllable structure and templatic phonology of Southern Sierra Miwok (henceforth SSM). SSM provides strong evidence for a model of phonological organization incorporating an x-slot tier (a 'segmental model'). I advance three arguments in favor of a segmental model. First, I argue that SSM exhibits floating x-slots and floating phonemes. SSM has a complex array of length and alternation phenomena. I demonstrate that by utilizing singly-linked phonemes, doubly-linked phonemes, floating x-slots, floating phonemes and combinations of these, all of the surface forms can be derived by syllabification without recourse to any special lengthening, shortening or deletion rules. I propose a hierarchy of elements in which x-slots with phonemic content have precedence over floating x-slots which in turn have precedence over floating phonemes.

Second, I show that the behavior of morpheme-final geminates in SSM is inconsistent with the moraic analysis of gemination proposed in Hayes (1989). Only a model which represents geminates as holding two positions or 'slots' will properly account for the gemination facts. The third type of evidence comes from the templatic system of SSM. I demonstrate that SSM exhibits the three distinct templates CVCVC, CVCVX and CVCVV. I propose that these can be represented by taking advantage of the distinctions between branching and non-branching Nucleus and between floating and non-floating x-slots. These distinctions readily follow from the x-slot model I advance herein but are unavailable in a moraic model of phonological organization.

The properties of syllabification in SSM appear paradoxical. On the one hand, it can be demonstrated that syllabification must apply at the word-level in order to account for the surface variation in vowel length. On the other hand, in order to explain the distribution of epenthesis, syllabification must arguably take place prior to the word-level. I propose a solution to this dilemma by arguing that syllabification in SSM takes place at two discrete stages. CV(X)

syllables are constructed at the lexical level. Subsequent word-level syllabification builds syllables from right-to-left, respecting previously built structure and Maximality. I demonstrate that Prosodic Syllabification, as proposed in Ito (1986, 1989) cannot correctly derive the SSM facts. This results from two (potentially) problematic aspects of SSM syllabification: (i) although syllabification must not apply cyclically, there are certain cyclic effects observed and (ii) epenthesis can only occur at morpheme boundaries even though these boundaries are not visible at the point in the phonology where syllabification must occur. These effects fall out of the analysis that I propose herein.

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Chapter 1

Introduction

This thesis examines aspects of the syllable structure and templatic phonology of Southern Sierra Miwok. In doing so, it addresses many issues of central concern to the theory of prosodic organization. In particular, the Southern Sierra Miwok data sheds light on the nature of sub-syllabic constituency, the behavior of floating elements in phonology, the representation of geminates, the nature of epenthesis and syllabification and the representation of templates.

1.1 Syllabic Organization

Most current models of syllabic organization fall into one of two distinct groups - segmental models or moraic models (utilizing terminology from Hayes 1989). Segmental models include those incorporating a CV tier (McCarthy 1979, Clements and Keyser 1983) as well as those incorporating an x-slot tier (Levin 1985, Lowenstamm and Kaye 1986). Hayes writes: "Both CV and X theory can be characterized as *segmental* theories of the prosodic tier: the number of prosodic elements in an utterance corresponds intuitively to the number of segments it contains" (Hayes 1989, p.254).

Moraic models (Hyman 1985, McCarthy & Prince 1986, 1990, to appear, Hayes 1989, Archangeli 1990), on the other hand, do not depict segment count. The unit of subsyllabic constituency in this model is the mora, which encodes syllabic weight: a light syllable has one mora, a heavy syllable has two.

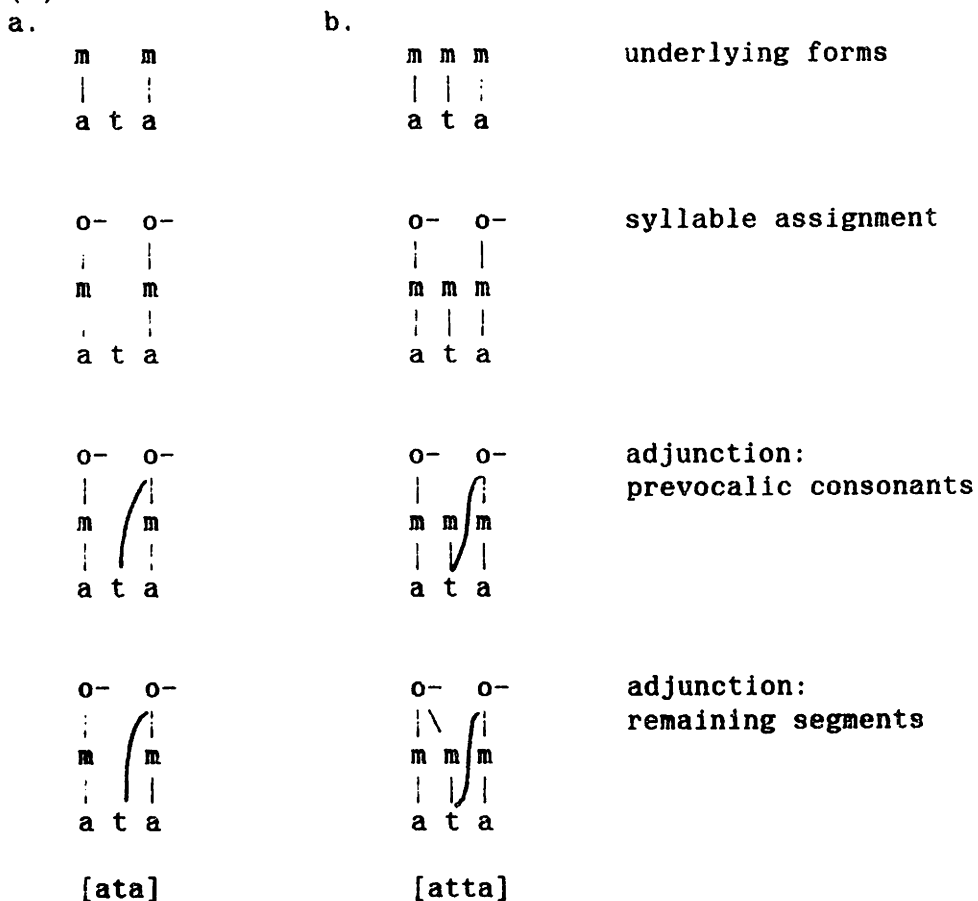
Moraic models are usually perceived as being more restrictive than segmental models. McCarthy and Prince (to appear) states: "prosodic morphology theory is more restrictive than CV skeletal theory (since the units of prosody are needed independently in either theory), and it is therefore to be preferred to it on general grounds of parsimony and learnability" (p. 4). Another argument often brought to bear against an x-slot model is that it is difficult to independently motivate the need for segment-sized skeletal units. McCarthy and Prince state that "[u]nambiguous evidence for segment-sized skeletal units is non-existent" (p.4).

I argue herein that the facts of Southern Sierra Miwok are inconsistent with a moraic model of phonological representation. Though there are many arguments advanced herein against a moraic analysis of SSM, three are worth special attention: (i) the behavior of morpheme-final geminates, (ii) the templatic data and (iii) the need to distinguish between floating and non-floating phonemes.

In a moraic account of geminates (Hayes 1989), a geminate consonant is represented underlyingly as a phoneme associated with a mora. Consonant length as such is not represented underlyingly but is derived when the

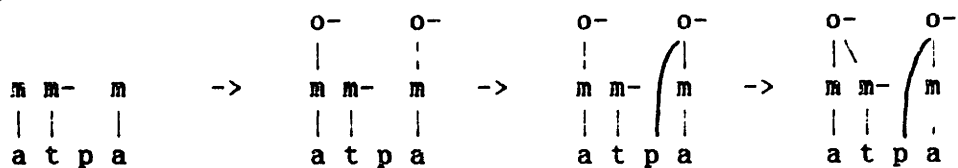
moraic consonant "spreads" onto a following syllable during the syllable-building process which adjoins onsets. This is represented below.¹

(1)



Note that a geminate consonant surfaces as long only when followed by a vowel. Below, is the moraic syllabification of an underlying geminate followed by a consonant (underlying att-pa).

(2)



Given this derived theory of gemination, when an underlying geminate is followed by a consonant, it will surface as a short consonant.

Southern Sierra Miwok has many morphemes which end in geminates. These will surface as long regardless of the nature of the following segment. For example, the underlying form *?yn:-jak-te-?* surfaces as *?ynnyjakte?* where the morpheme-final geminate is long and an epenthetic vowel is inserted. Morpheme-final geminates, and their consequences for moraic models of gemination are discussed in Chapter 2.1.

Another argument against a moraic model is based on the templatic phenomena of SSM. I demonstrate, in Chapter 4.4, that SSM templates must distinguish between CVV and CVC syllables. Since both of these are heavy in SSM, there is no way to distinguish the two types of syllables using a moraic model of syllabic organization. A three-way distinction in heavy syllables is actually necessary in SSM templates. This can be seen from the templates CVCVC, CVCV: and CVCVX. A root with three consonants *mola:p-* and a root with two consonants *ko:l-* associate to these templates to form the three distinct patterns below.

(3)	CVCVC	CVCV:	CVCVX
<i>mola:p-</i>	<i>molap</i>	<i>molaa</i>	<i>molap</i>
<i>ko:l-</i>	<i>kolu?</i>	<i>koluu</i>	<i>koluu</i>

While an x-slot model is capable of distinctly representing these templates, a moraic model is not.

A third argument in favor of an x-slot model comes from the behavior of floating consonants in SSM. SSM has suffixes of the shape CCV in which the initial consonant will surface only if it can be syllabified into the coda of a previous syllable: *marpo:sa-?ci-* -> *marpoosa?ci-* but *palal-?ci-* -> *palalci-*. These suffixes contrast with others of the same shape, like *-nti-*, in which the initial consonant must always surface: *kala:-N-ni-nti-?* -> *kalaaNyninti?* and *jaw:e-j-nti-?* -> *jawwejynti?*. I propose that the distinction between the two types of suffixes is that the ? of *-?ci-* is "floating" while the *n* of *-nti-* is not. This and other arguments for floating phonemes (as well as for floating x-slots) are presented in Chapter 2. The distinction between a floating and a non-floating phoneme is not stateable in a moraic model.

Ito (1989) makes the following claim about Prosodic Licensing:

"Prosodic Licensing requires that there be no unlicensed stray segments, and it is up to the language to decide whether to license them by syllabification (as in Ponapean and Japanese) or to eliminate them by Stray Erasure (as in Diola Fogy and Lardil)." (p. 239)

I demonstrate herein that SSM uses both options, in the following manner: stray phonemes which are associated to an x-slot (i.e. are not floating) will be licensed by syllabification (inducing epenthesis); stray phonemes which are floating are eliminated. Again, this distinction is only possible in a model incorporating segment-sized slots.

1.2 Two-stage Syllabification

An examination of syllabification in SSM leads to an interesting contradiction. On the one hand, it can be demonstrated that syllabification must apply at the word-level in order to account for the surface variation in alternating vowels. On the other hand, in order to explain the distribution of epenthesis, syllabification must arguably take place prior to the word-level. I propose a solution to this dilemma by arguing that syllabification in SSM takes place in two discrete stages (cf. Clements 1988, Dell and Elmedlaoui 1985, 1988, Kenstowicz 1985, Harris 1991).

I argue that (partial) syllabification occurs at the lexical level. At this level, syllabification locates the Nucleus, projects a syllable node, and incorporates onsets and codas. Epenthesis does not occur lexically. Stray consonants are allowed peripherally. If a morpheme has no vowel, it will remain completely unsyllabified at the lexical level.

Word-level syllabification applies from right-to-left and must 'respect' (in the sense that it can add to but not remove from) previously built syllable structure. I argue that word-level syllabification first scans the x-slot tier and then the phoneme tier. This reflects a general precedence relation - x-slots with phonemic content have precedence over floating x-slots which in turn have precedence over floating phonemes.

This two-level syllabification can account for both the restricted epenthesis sites and the vowel length phenomena. In addition, it accounts for certain pseudo-cyclic effects of epenthesis.

1.3 Templatic and non-templatic modes of operation

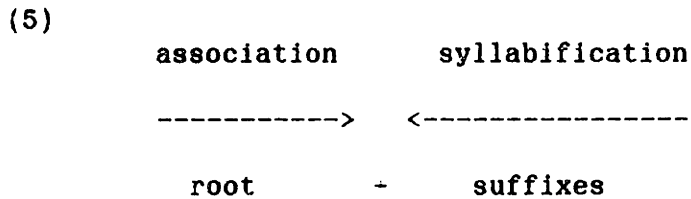
The phonological shape of a SSM word is derived through both templatic and non-templatic operations. The root, which is always word-initial, is often required to conform to the templatic shape provided by the following suffix. The suffixes, however, are linearly concatenated with the base. For example, when the root *tela-* 'paint, dye' is suffixed by *-hi:-*, it must conform to the CVC:VC template which this suffix requires, producing *tel:a?-hi:-*. As the root contains only two consonants, the third consonant position of the template is filled by the default consonant '?' (showing that association to the template occurs from left-to-right). This form can then be suffixed by *-me-*, *-h:Y-* and *-?-* to derive the word below.

(4)
tel:a?-hi:-me-h:Y-?
tella?hiimehhy?
it used to be painted

Thus the root shape is derived via association to a template, while the rest of the word is derived through linear concatenation.

There are a number of interesting differences between the templatic and non-templatic modes of operation. For example, the direction of

association to the template is from left-to-right, but word level syllabification in SSM is from right-to-left. There are thus two directions involved in the prosody, as below:



Another difference between the two is that in association to a template in SSM, spreading is generally prohibited - empty slots are filled by default insertion. In the non-templatic phonology of SSM, however, default filling of empty slots is prohibited - empty slots are always filled by rightward spreading (or by deletion). This is discussed in Chapter 2.

1.4 Organization of the Thesis

The thesis is organized in the following manner. Chapter 2 discusses the phenomenon of consonantal length and alternations in SSM. Consonants in SSM exhibit a three-way underlying length distinction. Consonants can be underlyingly short or long. In addition, there is a third length class which I call "alternating" - these phonemes exhibit a surface alternation between short and long which is dependent on syllabification. SSM also exhibits consonants which show surface alternations between null and short and consonants which show surface alternations between null and long.

I demonstrate that by using an x-slot model incorporating singly-linked phonemes, doubly linked phonemes, floating x-slots, floating phonemes and combinations of these, all of the patterns of length and alternation can be accounted for without recourse to any special lengthening, shortening or deletion rules. All of the surface patterns result from syllabification applying to the underlying representations of the string.

Chapter 2 contains an appendix which examines, and rejects, the argument against x-slot models advanced in Hayes (1989).

Chapter 3 develops an account of syllabification and epenthesis in SSM. Since the account of syllabification relies crucially on the behavior of vowel length alternations in SSM, vowel length is first discussed in detail. A two-level approach to syllabification is developed, in which partial syllabification applies at the lexical level. Word-level syllabification builds upon previously constructed syllable structure and incorporates stray consonants using epenthesis.

Chapter 4 examines some of the templatic phenomena of SSM. I argue in this Chapter that templates in SSM must be able to distinguish between a branching and non-branching Nucleus and between a floating and non-floating x-slot. This leads me to propose that templates in SSM consist of a string of syllabified x-slots, with floating slots allowed in peripheral position. This constitutes a strong argument in favor of an x-slot model of phonological organization.

The present Chapter concludes with some introductory remarks about SSM phonology.

1.5 Basics of Southern Sierra Miwok Phonology

Southern Sierra Miwok is a member of the Miwok language family. It was spoken in central California in the area that roughly corresponds to Mariposa County. Its position relative to other Miwok branches is shown in the following chart (from Broadbent and Callaghan 1960).

- (6)
 - A. Eastern Division
 - 1. Sierra
 - a. Southern
 - b. Central
 - c. Northern
 - 2. Plains
 - 3. Saclan
 - B. Western Division
 - 1. Coast
 - a. Bodega
 - b. Marin
 - 2. Lake

The primary reference source for SSM is Broadbent (1960). Also consulted are Freeland (1951) which is primarily a grammar of Central Sierra Miwok but which discusses structural differences among the three Sierra Miwok languages, and Freeland and Broadbent (1960) which contains a dictionary and texts of CSM.

Broadbent conducted her research on SSM from 1955-1961, using ten principal informants. During this period there were approximately twenty fluent speakers of the language. She estimated at that time that SSM would be extinct by 1980.

1.5.1 Phoneme Inventory

The phoneme inventory of SSM is represented in the following charts.

(7)

Consonants:

	Labial	Dental	Alveolar	Velar	Glottal
Stops and affricate	p	t	t̥ c	k	ʔ
Spirants		s	s		h
Nasals	m		n	ŋ	
Lateral			l		
Semivowels	w		j		

(8)

Vowels:

	Front	Central	Back
High	i	y	u
Low	e	a	o

Note that, because of printer limitations, I am using the symbol N to represent the velar nasal (η) and T to represent the alveolar voiceless stop (t). c is an alveolar affricate ($t^{\check{s}}$). With the exception that /N/ cannot occur word-initially all consonants are found in all positions.

In addition to the consonants in the above chart, the following phonemes are found only in loan words: b, d, g, f, ʃ and r.

Broadbent utilizes three morphophonemes in her description of SSM. Two of these, 'H' and ':', have to do with length and are discussed in detail in Chapter 2. The third is the morphophoneme //Y//, which Broadbent describes as follows:

"The morphophoneme //Y// is phonemically /y~/u~/o/, in accordance with the quality of the preceding vowel, as follows: (1) when the preceding syllable contains /u/, //Y// is /u/; (2) where /o/ is the vowel of the preceding syllable //Y// is /u/ [in free alternation with] /o/ ... (3) elsewhere, //Y// appears as /y/." p. 20

Although Broadbent states that the morphophoneme will show free alternation between u and o when the preceding syllable contains o, she gives no examples in the general text of //Y// surfacing as o. The morphophoneme //Y// is both an underlying vowel and the epenthetic vowel in SSM. It is also the "default" vowel that fills the rightmost vocalic slots in a template if the root does not contain enough vowels to fill all the available slots. As McCarthy (1989) points out, this is inconsistent with complete underspecification but follows from the notion of contrastive underspecification argued for in Steriade (1987).²

1.5.2 Organization of the Data

Some comments regarding the presentation of the data herein are necessary. Throughout most of the text, the data is arranged in the following manner. On the first line, I give the morphemic breakdown, which indicates the individual morphemes (separated by the symbol '-') in their underlying forms (as posited by Broadbent). This representation includes the notations ':' (length) and 'H' (alternating length), discussed in Chapter 2. The number in parentheses (preceded by 'B') refers to the page number in Broadbent where the word is discussed. On the second line, I give the surface form (which Broadbent calls the 'phonemic' form) which shows the results of lengthening phenomena and epenthesis.³ The third line contains the gloss.

Throughout the grammar, Broadbent utilizes the morphemic form as the citation form, only giving the surface form where she deems it necessary to demonstrate the effects of lengthening rules and epenthesis. Her descriptive accounts of the processes of syllabification, length and epenthesis are thorough and thus it is possible to derive the surface form for those cases where she does not provide one. I will sometimes cite cases for which only the morphemic representation is given (particularly when describing templatic phenomena). However, I consider the data set to consist primarily of that set of words for which Broadbent has provided both levels of representation. The generalizations and analysis herein with respect to length alternations

and syllabification are based on this restricted set of data, though I utilize the broader set of data to corroborate any claims I make.

1.5.3 Syllables, Stress and Metrical Structure

Allowable syllable types in SSM are CV, CVV and CVC. There are no complex onsets or codas and no sequences of non-identical vowels. Onsets are required. Unsyllabifiable sequences are broken up by epenthesis, which is restricted to apply at morpheme boundaries. The epenthetic vowel is //Y//, which is realized as u if the preceding syllable contains either u or o, and as y elsewhere. Examples follow. (Epenthesis will be discussed in detail in Chapter 3.)

(9)		
kosen-ka-n-h-N (B51)		?is:ak-N:-? (B51)
kosenkanhyN		?issakyNNy?
cook it for him later		it is his
hune:m-ma: (B56)		hol:op-m-? (B53)
huneemymaa		hollopmu?
I am fishing		in the hole

Both CVV and CVC syllables are treated as heavy in the determination of stress. That the two pattern together is emphasized by Broadbent's treatment of length, which she considers a consonant even when it represents vocalic length. (Broadbent uses the symbol '.' to represent length; I have systematically replaced this symbol with ':'.) She states: "Length [' : '] is simply a continuation of the preceding vowel or consonant, whatever its allophonic quality. [...] It is here treated as a consonantal phoneme because this procedure makes it possible to simplify many statements, especially those concerning canonical forms

and rules of stress" (p. 14). The canonical form CVC thus includes both CVC and CV:.

Stress is described as follows:

"The syllable canon of this language is notably rigid. When length is treated as a consonant, as is done here, only two syllable types are found: CV and CVC. These will be referred to as SHORT SYLLABLES and LONG SYLLABLES respectively. [...] Stress, which is not phonemic, can be predicted from the pattern of long and short syllables within the word. [...] In isolated forms, primary stress falls on the first long syllable. Primary stress is marked by the following factors: (1) the syllable bearing it is louder than surrounding syllables; (2) the syllable-final consonant is a little longer than usual (if this consonant is /./, this means that the phonetic vowel length is maintained for longer than usual); and (3) if a short syllable (weakly stressed) immediately precedes, the long syllable is higher in pitch than the short one.

Secondary stress falls on succeeding long syllables. In a sequence of long syllables, the even-numbered ones tend to be less-heavily stressed than the odd-numbered ones, counting from the beginning of the long-syllable sequence. Short syllables carry weak stress." (p. 16-17)

Using the theory of stress developed by Halle and Vergnaud (1987), we can analyze SSM stress as follows. Light syllables are metrically inert. We can assume, then, that only heavy syllables are projected onto line 0 (i.e. only heavy syllables enter into the determination of stress). Binary trochaic feet are constructed on line 0, and an unbounded trochaic foot on line 1. This will ensure that the initial syllable receives primary stress and will generate alternating secondary and tertiary stresses on succeeding heavy syllables.

-- Notes --

1. Due to printer limitations, I utilize the symbol 'o-' for 'syllable node' and 'm' for 'mora'.

2. This same comment holds of the default consonant, the glottal stop, which is also part of the underlying phonemic inventory. McCarthy notes: "the pattern predicted by complete underspecification is unknown to me: a template in which the default consonant never appears in roots, emerging only when the template is not otherwise satisfied" (McCarthy 1989, p. 93).

3. Though I refer to this as the 'surface' form, it is not a phonetic characterization and does not include certain processes like labialization of k in particular environments and assimilation of j to i in the sequence ij.

Chapter 2

The Characterization of Length and Consonantal Alternations

The patterns of consonantal length and alternations exhibited by SSM are quite elaborate. In this Chapter, I demonstrate that by using singly-linked phonemes, doubly-linked phonemes, floating x-slots, floating phonemes and combinations of these, we can account for all of the patterns exhibited.

I provide evidence for both floating x-slots and floating phonemes from the alternation and lengthening phenomena of SSM. I demonstrate that there is a hierarchy of elements as follows: an x-slot with associated phonemic content takes precedence over a floating x-slot which in turn takes precedence over a floating phoneme. No special lengthening or deletion rules are needed.¹ All of the surface patterns result from syllabification applying to the underlying representations of the string.

The Chapter is organized in the following manner. Section 3.1 discusses underlying geminates. Section 3.2 argues for a floating x-slot in SSM. The argument concerns suffixes which trigger lengthening of the final phoneme of a preceding morpheme. Also discussed in this Section is the

interesting phenomenon of long epenthetic vowels and consonants. In Section 3.3 I provide evidence for floating phonemes in SSM. Section 3.4 concerns alternating consonants. It demonstrates that by combining a floating consonant with a floating x-slot, the correct patterns of alternation are derived by syllabification.

The Chapter contains an appendix, which addresses Hayes (1989) argument against x-slot models of syllabic structure. I will show, contra Hayes, that x-theory is capable of describing the compensatory lengthening phenomena.²

2.1 Inherent Length

The morphophoneme which Broadbent terms "length" most closely corresponds to our notion of underlying length. She represents it with the symbol '.'; I have systematically replaced this symbol with ':'. The length morphophoneme may follow either a consonant or vowel and represents length of the preceding phoneme. Examples follow.³

(1)	
cym:e-to-t (B115)	han:a-?-mah:i: (B132)
cymmetot	hanna?mahhi
to the south	[??]

Length is distinctive in SSM. This can be seen in the templatic system where various templates are distinguished in terms of length (for example, CVCVC, CVC:VC, CVCV:C and CV:CVC). It can also be seen in the non-templatic phonology, as in the following minimal pairs:⁴

(2)

-p:a- distributive reference

keNke-p:a-koH 'they're going in single file' cf.

keNke-leHp- 'single'

haj?e-p:a-j 'every few days; once in a while' cf. haj:e-
'close by; a while'

-pa- directional

?yny:-pa-h:aj-nY-: 'he wants to come to him' cf. ?yn:-
'to come'

?uk-pa- 'to go in to (him)' cf. ?u:k- 'to enter'

(3)

-m:a- 'one who X to excess'

hel:aja-m:a- 'one who is easily scared; a coward' cf.

hela:j- 'to scare'

noc:u?u-m:a- 'a cry-baby' cf. nocuH- 'to cry'

-ma- agentive

hyhy:-ma- 'dragger' cf. hyhy:-t- 'to pull'

wyn:is-ma- 'visitor' cf. wyn-si 'to come to visit'

(4)

-j:a- plural

?esle-j:a- 'children' cf. ?esel:y- 'child'

kawja-j:a- 'horses' cf. kawa:ju- 'horse'

-ja- iterative

kal-ja 'to kick all over' cf. ka:l- 'to kick with the
heel'

myl-ja- 'to beat up' cf. my:l- 'to hit with a stick'

(5)

-j:- iterative

mi?wa-j:- 'to squirm; to wiggle' cf. mi?-wa- 'to wriggle through'

helka-j:- 'to be summer' cf. hela:k- 'to be clear, sunny'

-j- verbalizer

?ucu:-j- 'to build a house' cf. ?u:cuH- 'house'

muku:-j- 'to make a road' cf. muk:u- 'trail, road'

-j- future

hy:ja-j-te-? 'I will arrive' cf. hy:ja- 'to arrive'

liwa-ksY-j-ni-? 'you will talk' cf. liwa-ksY- 'to talk'

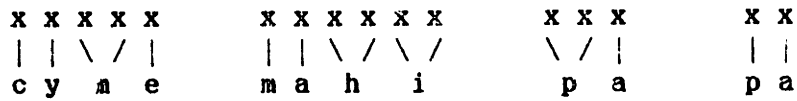
I assume herein a three-dimensional model of phonological organization in which a number of planes (for example, a segmental or phoneme plane and a syllable plane) intersect at the x-tier or skeleton (cf. Levin 1985). The skeletal slots (x-slots) represent units of time and are linearly ordered. In this model phonemic length is defined in terms of the relationship between an element on the segmental tier and the skeleton. A 'short' segment consists of a phoneme which is singly associated to an x-slot; a 'long' segment consists of a phoneme which is doubly associated to adjacent x-slots. Examples follow.

(6)

	short	long
x-tier	x	x x
		\ /
phoneme tier	p	p

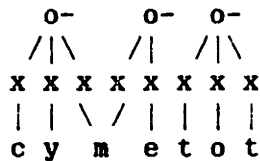
The SSM morphemes *cym:e-*, *-mah:i:*, *-p:a-* and *-pa-* are thus represented as follows.

(7)



For the purposes of this Chapter, I will for the most part ignore the hierarchical syllabic structure above the level of the x-tier. The diagrams herein will represent the syllable as flat, as below.

(8)



This is done not only to simplify the representations but also because the purpose of this Chapter is to provide support for the x-tier itself and not to argue for any particular model of the hierarchical organization of x-slots into syllables. Certain aspects of this higher structure will be explored in Chapter 4.

SSM exhibits morpheme-final gemination as in 9. Included in this set are morphemes consisting only of a geminate consonant as in 5 above and 10.

(9)

?elNe-met:-a-: (B74)
 ?elNemettaa
 he got left behind

?enh-jik:-keH-? (B69)
 ?enhyjikkyke?
 he went to fix it

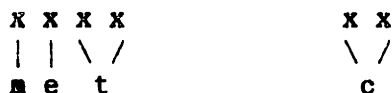
(10)

nyt:y-c:-ni-?-hY: (B111)
 nyttyccyni?hyy
 he might keep still

mi-c:-tho-j (B114)
 miccythoj
 why?

The representation of these is straightforward under the model I am assuming, as shown below for *-met:-* and *-c:-*.

(11)



2.1.1 Morpheme-final geminates and moraic models

The SSM data are problematic for moraic models of syllabic organization on a number of different grounds, one of which is the representation of morpheme-final geminates. Before discussing the particulars of SSM, let us examine a moraic account of gemination. The most comprehensive account is that of Hayes (1989), which I outline below.

Hayes distinguishes geminate consonants from single consonants in underlying representations by assigning them a single mora. The surface double-linking of geminates is not part of the underlying representation but is derived by the syllabification rules. Hayes assumes that syllabification consists of syllable assignment, which selects "certain sonorous moraic segments, on a language-specific basis, for domination by a syllable node" (p. 257), and by adjunction of onsets to the syllable node and adjunction of codas. Below I illustrate this with the derivations of *ata*, *apta* and *atta* for a language in which all closed syllables count as heavy (from Hayes' example (11) p. 259).

(12)

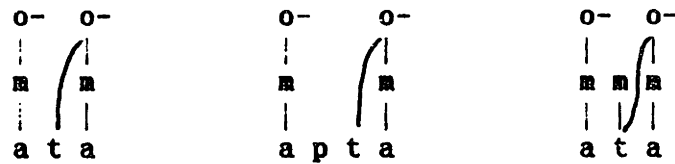
Underlying forms:



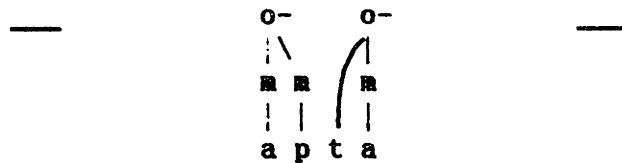
Syllable assignment:



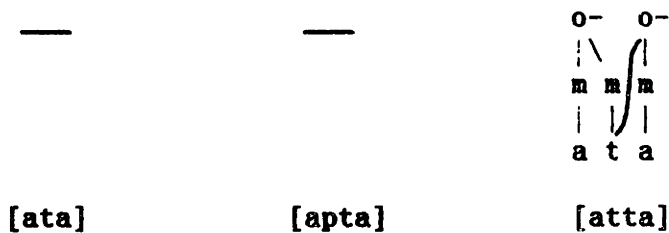
Adjunction: prevocalic consonants:



Adjunction: Weight by Position:



Adjunction: remaining segments:



The important thing to note is that the geminate is a derived structure. It is derived through the syllabification process in which prevocalic consonants are adjoined as onsets. This leads to an interesting question: How does one represent final geminates? The question is even

more intriguing in SSM, where morpheme-final geminates are often followed by consonant-initial morphemes. Before discussing the SSM data, let us examine the predictions that Hayes' account would make.

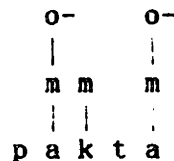
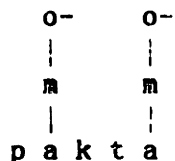
Suppose that we have two morphemes - *pak* and *pakk*. If these are suffixed by a V-initial suffix, such as *-a*, Hayes's account would derive the surface forms *paka* and *pakka*. On the other hand, if they are followed by a C-initial suffix, such as *-ta*, Hayes's account would predict *pakta* in both cases, as demonstrated below. According to Hayes's theory, the distinction between the single and geminate consonant is thus neutralized in this environment.

(13)

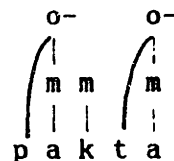
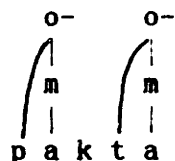
Underlying forms:



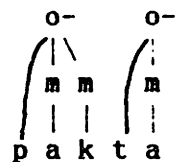
Syllable assignment:



Adjunction: prevocalic consonants:



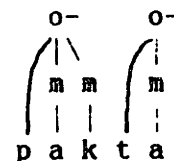
Adjunction: Weight by Position:



—

Adjunction: remaining segments:

—



[pakta]

[pakta]

The derivational approach to geminates thus predicts that a consonant which is underlyingly geminate (i.e. has a mora) will surface as a single consonant when followed by a consonant.

This is not the case in SSM where morpheme-final geminates always surface as geminates, whether followed by a consonant or a vowel, as shown by the pair below.

(14)

a.

?yn:-eH-Nko? (B61)

?ynneNko?

I'll come while...

b.

?vn:-jak-te-? (B99)

?ynnyjakte?

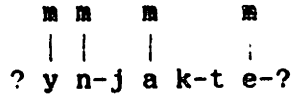
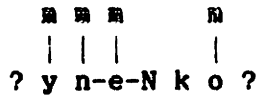
I'm from...

Below I give the derivations of the words in 14 under a moraic analysis and under the x-slot analysis adopted herein.⁵ As we can see in 15 the moraic account will incorrectly derive ?ynjakte? for the form in 14b. An x-slot account, on the other hand, correctly predicts the surface forms of these words as shown in 16.

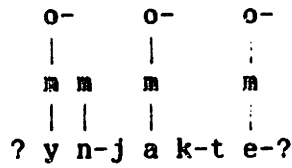
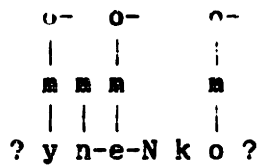
(15)

A moraic account:

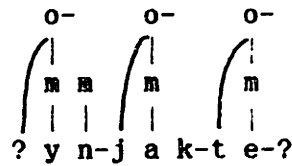
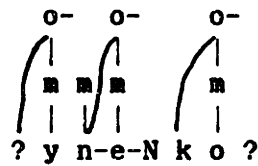
Underlying forms:



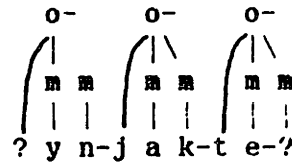
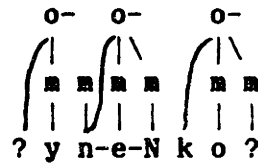
Syllable assignment:



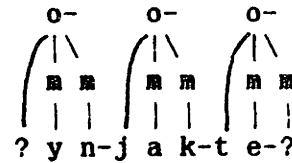
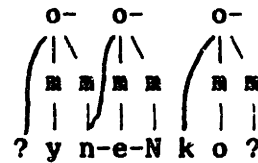
Adjunction: prevocalic consonants:



Adjunction: Weight by Position:



Adjunction: remaining segments:



[?ynneNko?]

* [?ynjakte?]

(16)

a. Underlying representation:

```

x x x x-x-x x x x
| | \ / | | | | |
? y n e N k o ?

```

```

x x x x-x x x-x x-x
| | \ / | | | | |
? y n j a k t e ?

```

b. Syllabification:

```

  o-      o-      o-
 /|\     /|\     /|\
x x x x-x-x x x x
| | \ / | | | | |
? y n e N k o ?

```

```

  o-      o-      o-
 /|\     /|\     /|\
x x x x-x x x-x x-x
| | \ / | | | | |
? y n j a k t e ?

```

c. Epenthesis:

n/a

```

  o-      o-      o-      o-
 /|\     /|\     /|\     /|\
x x x x x x x x-x x-x
| | \ / | | | | |
? y n y j a k t e ?

```

We can see from these examples that the behavior of morpheme-final geminates in SSM provides a clear counter-example to one of the major predictions of Hayes (1989) moraic analysis of gemination: that geminates are derived by the (syllabification) process that provides an onset to a following vowel. Geminates in SSM will surface as geminate whether they are followed by a consonant or a vowel. Thus they cannot be derived in the manner Hayes proposes but rather, must be underlyingly marked as long (holding two 'positions') and not as merely moraic. The behavior of morpheme-final geminates follows from the representation they are assigned in an x-slot account of syllabic structure (i.e. a phoneme doubly-linked to adjacent x-slots).⁶

2.2 Suffixes which trigger preceding length

Many suffixes in SSM are represented by Broadbent as beginning with the symbol ':'. These suffixes cause the final phoneme of the preceding morpheme to lengthen, as is shown below for the suffixes -:e- and -:a- and -:me?-.⁷

(17)

a.
?enup-:e-ni:te-? (B48)
?enupenniite?
I chased you

b.
lakyh-:e-? (B49)
lakyhhe?
he came out

c.
halik-:e-te-? (B106)
halikkete?
I hunted

d.
kalaN-:e-me-? (B106)
kalaNNeme?
we danced

(18)

a.
joh-:a-ci-?-hY: (B119)
johhaci?hyy
it was killed

b.
jo:h-k-:a-ko: (B82)
joohukkakoo
they were killed

c.
hyjeN-:a-po-tki-? (B119)
hyjeNNapotki?
little mirror

d.
?am:u-k-:a-? (B106)
?ammukka?
he got hurt

(19)

a.
kel:a-na-:me? (B63)
kellanaame?
it snowed on us

b.
lit-h-a-:me? (B63)
lithaame?
it's risen on us

Though the length shows up on a preceding morpheme, we can show that it is in fact a property of the ':'-initial suffix. In 18b and d, the morpheme -:a- follows the morpheme -k- 'passive; mediopassive' (allomorph of -NHe-), which lengthens to become the surface geminate *kk*.

This lengthening only occurs when *-k-* is followed by a suffix beginning with ':'. For example, in addition to the suffix *-:a-* 'past nominal', SSM has the suffix *-a-* 'present perfect modal.' Below are examples of each of these preceded by *-k-*.

(20)		
jo:h-k-a-:	(B82)	jo:h-k-:a-ko: (B82)
joohukaa		joohukkakoo
he got killed (pres. perfect)		they were killed

As we can see, the *k* geminates when followed by the morpheme *-:a-* but not when followed by *-a-*. The gemination is thus triggered by the presence of the suffix *-:a-* and is not an intrinsic property of the morpheme *-k-*.

Above we represented length by the double association of a phoneme to two slots on the timing tier. Clearly that representation will not be sufficient here since the length is to be characterized as part of the suffix but the segment which surfaces as long is part of a preceding morpheme. I propose that suffixes of this type have an initial floating *x*-slot and will refer to them hereafter as "floating-*x* suffixes." (For analyses involving floating skeletal slots, see Clements and Keyser 1983, Marlett and Stemberger 1983, Borowsky 1985, Everett and Seki 1985 and Lowenstamm and Kaye 1986.) The representations of *-:a-* and *-:me?-* are thus as in 21, and *?ammukka?* and *lithame?* are derived by spreading as in 22. (Note that the direction of spreading in SSM is rightward.)

(21)		
x x		x x x x
a		m e ?

(22)

a. Concatenation

x	x	x	x	x	+	x	+	x	x	+	x
		\	/								
?	a	m	u	k		a	?				

x	x	x	+	x	+	x	+	x	x	x	x
l	i	t		h		a		m	e	?	

b. Spreading

x	x	x	x	x	x	x	x	x
		\	/		/			
?	a	m	u	k		a	?	

x	x	x	x	x	x	x	x	x
				/				
l	i	t	h	a		m	e	?

Broadbent discusses fourteen suffixes of this type, listed below. (If the suffix has an allomorph, it is listed in parentheses.)

(23)

-:V(X)-

- :e- past (-keH-)
- :e- "to be (hot, salty, etc.)"
- :a- past nominal
- :a- agentive
- :i- passive, mediopassive (-NHe-)
- :u-maH- passive participial
- :ene:-/ -:enik- "to ask someone to ... "

-:C(X)-

- :me?- 3s1p Series 3 pronominal suffix
- :h- static (-c:-)
- :muH- predicative
- :ni- augmentative
- :liH- [meaning obscure]
- :pa- "to (do something) ... times"
- :po- "to put on ...; to apply ...; to fasten with..."

2.2.1 Long Epenthetic Phonemes

When a suffix of the shape -:C(X)- follows an unsyllabifiable consonant SSM exhibits an interesting phenomenon - a long epenthetic vowel. Examples follow.

(24)

?opa:-t-:me? (B63)
?opaatyyme?
its clouding up on us

?umu:c-:me? (B63)
?umuucuum?
its raining on us

This pattern clearly arises because of the properties of the suffix -:me?-. We can see this by comparing 24 with 25, which shows the suffix -ma:- in the same environments as the suffix -:me?- in 24.

(25)

hywa:-t-ma: (B36)
hywaatymaa
I am running

hune:m-ma: (B56)
huneemymaa
I am fishing

The examples in 25 show the normal pattern of epenthesis; the long epenthetic vowel found in 24 is triggered by the floating-x suffix. This unusual pattern (long epenthetic vowel) can be explained if we assume that epenthesis applies and then the epenthetic vowel is spread onto the floating x-slot. To see this, let's examine the derivation of ?umuucuum?.

Note that syllabification is discussed in detail in Chapter 3. I propose there that syllabification takes place at two levels. CV(X) syllables are constructed lexically, with unsyllabified material remaining stray (no epenthesis or deletion occurs lexically). Syllabification applies again at the word-level. At this level stray consonants will be licensed by incorporating them into previously built syllables or by epenthesis. Floating elements which do not get incorporated into syllabic structure are eliminated through the process of Deletion. For this derivation, the important thing to note is that

lexical syllabification leaves the final root consonant (as well as the floating x-slot of the suffix) unsyllabified, as below.

(26)

a. Underlying Representation

```

x x x x x x + x x x x
| | | \ / |   | | |
? u m u c     m e ?

```

b. Lexical Syllabification

```

      o-  o-           o-
      /|  /|\         /|\
x x x x x x + x x x x
| | | \ / |   | | |
? u m u c     m e ?

```

We can assume that the long epenthetic vowel is derived by the application of epenthesis and spreading of the epenthetic vowel onto the floating x-slot:

(27)

c. Epenthesis, Spreading

```

      o-  o-   o-   o-
      /|  /|\  /|\  /|\
x x x x x x x x x x x
| | | \ / | | / | | |
? u m u c u   m e ?

```

Note that epenthesis does not apply in such a way as to simply fill (provide features to) the empty x, as shown below.

(28)

a. Representation prior to epenthesis

```
      0-  0-          0-
     /|  /|\        /|\
    x x x x x x + x x x x
    | | | \ / |    | | |
    ? u m u c      m e ?
```

b. Epenthesis

```
*      0-  0-          0-
     /|  /|\        /|\
    x x x x x x + x x x x
    | | | \ / |    | | | |
    ? u m u c      u m e ?
```

*?umuucume?

This shows that epenthesis is not an operation which provides phonemic content to empty x-slots but rather, that it is a process which involves insertion of an x-slot with associated phonemic content.⁸ This is also evidence of a general property of SSM non-templatic phonology - empty slots are filled by spreading and not by default insertion. (This is precisely the opposite of what occurs in the templatic phonology, where spreading is generally not allowed and empty slots are filled by default insertion; see Chapter 4.)

Note that I have not given a rule for epenthesis and have glossed over syllabification procedures in this discussion. The goal here is solely to point out how the long epenthetic vowel arises as a result of the interaction of epenthesis and the floating x-slot found in suffixes such as -:me?-.

A similar pattern (spreading of an epenthetic phoneme) is exhibited when a suffix of the shape -:V(X)- follows a vowel-final morpheme. In these cases, a long glottal stop occurs, as below.

(29)
 ?ese:l-NHe-:a-ci-?-hY: (B119)
 ?eseelyNNe??aci?hyy
 his birth

In order to understand this pattern, a closer look at SSM syllable structure is in order. Recall that onsets are obligatory in SSM. In those instances where concatenation would lead to adjacent vowels, a glottal stop is inserted to break up the hiatus. Broadbent treats these cases as suffixal allomorphy. For example, the suffix *-iH-* has two allomorphs: *-iH-* following consonants and *-?iH-* following vowels. The suffix *-ajaHk-* shows the same allomorphy, as below.

(30)
 hal:ik-iH- 'habitual hunter' cf. hal-ki- 'to hunt'
 lotu-ksY-?iH- 'habitual holder' cf. lotu-ksY 'to hold'
 mola:p-ajaHk- 'mush-makers' cf. mola:p- 'to make acorn
 mush'
 tolti:ja:-nY-?ajaHk- 'tortilla makers' cf. tolti:ja:-nY-
 'to make tortillas'

Broadbent also treats the long glottal stop as allomorphic. Thus *-:a-* 'agentive' has two allomorphs: *-:a-* following consonants and *-?:a-* following vowels, as shown below.⁹

(31)
 mol:ap-:a- 'mush-making place' cf. mola:p- 'to make acorn
 mush'
 le:le:-nY-?:a- 'school' cf. le:le:-nY- 'to read'

We can account for these alternations without positing distinct allomorphs. The suffixes in question are thus *-iH-*, *-ajaHk-* and *-:a-* with no allomorphy exhibited. SSM contains a rule which inserts a glottal stop to break up vowel hiatus. Let's examine this process in more detail.

Notice that the cases of long epenthetic glottal stop are entirely complementary to the cases of long epenthetic vowels. Epenthesis and glottal stop insertion normally result in the insertion of a single phoneme (as in 25 and 30); the length results from spreading onto a floating-x suffix. Thus, as in the case of vowel epenthesis, we must rule out a derivation in which the glottal stop simply fills the empty onset position, as below.

(32)

a. Syllabification

o-	o-	o-	o-
/ \	/ \	/ \	/ \
x x x	x x x	x-x	x-x
\ /	\ /		
l e	l e	n Y	a

b. Default onset insertion

o-	o-	o-	o-
/ \	/ \	/ \	/ \
x x x	x x x	x-x	x-x
\ /	\ /		
l e	l e	n Y ?	a

* leeleeeny?a-

As in the case of vowel epenthesis, we can derive the correct surface form if we assume that the glottal stop is inserted with an x-slot and is then spread onto the empty x-slot, as below.

(33)

a. Glottal stop insertion

```

      o-   o-   o-   o-
     /|\  /|\  /|   /|
    x x x x x x x x x x-
     | \ / | \ / | | | |
     l e l e n Y ?  a
  
```

b. Spreading, Syllabification

```

      o-   o-   o-   o-
     /|\  /|\  /|\  /|
    x x x x x x x x x x-
     | \ / | \ / | | | / |
     l e l e n Y ?  a
  
```

leeleeny??a-

Notice that by deriving the surface form in this manner, the process of glottal stop insertion is not directly related to supplying an onset. If that were so, we would expect a derivation as in 32. Instead, in 33, the glottal stop is inserted not in the empty onset position but to its left, where it is syllabified into the coda of the preceding syllable. This suggests that that the glottal stop is inserted not to supply an onset but rather to break up vowel hiatus (which in the normal case has the result of supplying an onset to an onsetless syllable). The rule can be stated as follows:

(34)

Glottal Stop Insertion

```

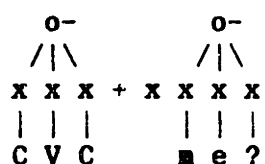
      x
      |
    0 -> ? / V _ V
  
```

A glottal stop (associated with an x-slot) is inserted whenever there are adjacent vowels. Note that adjacency must be determined on the phoneme tier. As we can see in 32a, the relevant vowels are adjacent on the phoneme tier but not on the x-tier (where the floating x-slot intervenes between them).

2.2.2 Distribution of floating-x suffixes

In the discussion above, I have shown the behavior of a suffix such as $-\text{:me?}-$ following a short vowel (the vowel spreads onto the floating x-slot) and following an unsyllabified consonant (epenthetic vowel is inserted and then spreads onto the floating x-slot). Notice that I have not discussed a case in which a $-\text{:C(X)}-$ suffix follows a syllabified consonant (i.e. follows a CVC sequence), as below.

(35)



Here we find an intriguing gap in the SSM data. There is no instance in the entire Broadbent grammar of such a suffix following the sequence CVC. This leads to a dilemma - should it be considered an accidental gap in the data set or does it reflect some systematic property of SSM? A possible resolution to this dilemma can be found in the behavior of a set of suffixes which Broadbent notates as beginning with the morphophoneme 'H'.

2.2.3 'H'-initial suffixes

Broadbent utilizes two morphophonemes to notate length - ':' and 'H'. A phoneme followed by ':' is long; a phoneme followed by 'H' alternates between long and short in a systematic manner. The morphophoneme 'H' is described in detail in Section 2.4 below and in Chapter 3. For now, we are concerned only with those suffixes which begin with 'H'.

Following a vowel, an H-initial suffix exhibits the same pattern as a ':'-initial suffix - it causes lengthening of the preceding vowel. This is demonstrated below with the suffixes *-HmetiH-* and *-Hs-*.¹⁰

(36)

-HmetiH-

cicka-HmetiH-j (B131)

cickaametii

[??]

pace-mhi-HmetiH-? (B110)

pacemhiimetii?

relatives to each other

law:a:ti-HmetiH-?

(B122)

lawwaatiimetii?

there are several snakes

?i-HmetiH-j-?ok (B131)

?iimetii?ok

[??]

-Hs-

jaw:e-Hs-?-hY: (B54)

jawweesy?hyy

with his bow

Unlike the ':'-initial suffixes, however, H-initial suffixes are found following syllabified consonants, as below.

(37)

noc:u?-HmetiH-koH (B122)
noccu?metiikoo
they are people who cry

?uc:um-HmetiH-? (B123)
?uccummeti?
there are several flies
in the group

his:ik-HmetiH-? (B122)
hissikmeti?
several skunks

joh:e?-HmetiH-? (B122)
johhe?meti?
Yosemite people ('they
are killers')

-Hs-

hiciw-Hs-? (B54)
hiciwsy?
with a poker

ca:maj-Hs-nti-? (B53)
caamajsynti?
by means of my
seed-gathering basket

As we can see from the above examples, when an H-initial suffix follows a CVC sequence there is no lengthening, epenthesis or any other effect. Such suffixes thus exhibit the following pattern: they cause lengthening of a preceding vowel, but have no effect on a preceding consonant. There is an interesting distributional fact about H-initial suffixes: there is no example of an H-initial suffix preceded by an unsyllabifiable consonant.

Thus, we have two sets of suffixes which cause lengthening of a preceding morpheme. Following short vowels their behavior is identical. Following consonants, we find that the two sets are in a sort of complementary distribution: ':'-initial suffixes occur after CVVC or CVCC sequences but never after CVC; H-initial suffixes occur after CVC but never after CVVC or CVCC. This distributional fact suggests that, although treated as two distinct sets by Broadbent, the ':'-initial and H-initial suffixes fall into the same set. I propose that they in fact

have identical representations: both types of suffixes have an initial floating x-slot, and their surface patterns are a result of this property.

This distributional argument for treating H-initial and ':'-initial suffixes in the same manner might not seem convincing, particularly in light of the fact that in other positions (i.e. non morpheme-initial positions) ':' and 'H' are arguably distinct (see 2.4). A further argument for treating the H-initial suffixes as floating-x suffixes has to do with their behavior following alternating vowels. Since the argument can only be made with reference to the complicated patternings of alternating vowels, I postpone discussion to Chapter 3. (Note that, although the two sets of suffixes are in complimentary distribution after consonants, I have no explanation for the fact that any particular floating-x suffix can be found after either CVC or CVVC/CVCC but not both.)

The (partial) representation of *-HmetiH-* is given in 38. For the purposes of this discussion, I will treat the final vowel of this suffix as if it were short. (See Chapter 3 for the representation of alternating vowels.)

(38)

```

x x x x x
 | | | |
m e t i

```

When *-HmetiH-* follows a vowel-final morpheme, the preceding vowel will spread onto the floating x-slot, creating a long vowel. This is demonstrated below.

(39)

a. Concatenation

```

x x x x x x x x-x x x x x-x
| | \ / \ / | | | | | |
l a w a t i m e t i ?

```

b. Spreading

```

x x x x x x x x-x x x x x-x
| | \ / \ / | | / | | | | |
l a w a t i m e t i ?

```

Now let us consider the derivation of *hissikmeti?*, in which *-HmetiH-* follows a consonant-final morpheme, as below.

(40)

```

x x x x x x-x x x x x-x
| | \ / | | | | | |
h i s i k m e t i ?

```

In order to derive *hissikmeti?* from 40, we need only to delete the floating x-slot. I propose that this is accomplished by the process of Deletion, which deletes floating phonemes (and, I argue, floating x-slots). Deletion is discussed in 2.3 and in the discussion of templates in Chapter 6.

Deletion is the last step of a derivation and presumably applies after Spreading. This leads to an interesting question: in 40 above, what prevents the root-final consonant from spreading onto the floating x-slot, as below.

(41)

```

* x x x x x x-x x x x x-x
  | | \ / | | / | | | | |
  h i s i k m e t i ?

```

Compare this to *lakyhhe?* (*lakyh-:e-?*) in which the final consonant of the root does spread:

(42)

a. Concatenation

```

x x x x x-x x-x
| | | | | | |
l a k y h e ?

```

b. Spreading

```

x x x x x-x x-x
| | | | | / | |
l a k y h e ?

```

The difference between the two cases lies in their syllabification. Syllabification of these words results in the following representations:¹¹

(43)

a.

```

o- o- o- o-
/|\ /|\ /| /|\
x x x x x x-x x x x x-x
| | \ / | | | | | |
h i s i k m e t i ?

```

b.

```

o- o- o-
/| /|\ /|\
x x x x x-x x-x
| | | | | | |
l a k y h e ?

```

In 43a the floating x has not been syllabified; in 43b, the floating x has been syllabified as an onset. In the latter case, the x-slot is thus no longer 'floating', rather it is an 'empty' x-slot. I propose the following distinction between these two terms. A floating x-slot is completely unassociated - there is no element on any plane to which it is associated. An empty x-slot is an x-slot that has no phonemic content but is licensed via association to the syllable plane.

SSM distinguishes between floating and empty x-slots in two ways. First, the operation of Spreading targets empty x-slots (phonologically empty, syllabically licensed x-slots). This means that a phoneme will spread only onto an x-slot which is syllabified but lacks phonemic content.¹² This accounts for the difference between the two forms in 43. The *k* in *hissik* will not spread onto the following x-slot because it is floating; the *h* in *lakyh* will spread because the following x-slot is empty.

The second distinction between the two types of phonemically null x-slots is that the operation of Deletion targets floating elements; it will delete floating x-slots but not empty x-slots. The floating x-slot in 43a remains floating and is thus subject to Deletion. A derivation of the two forms in question follows:

(44)

a. Syllabification

o-	o-	o-	o-
/ \	/ \	/ \	/ \
x x x	x x x-x	x x x	x-x
h i s	i k	m e t	i ?

o-	o-	o-
/ \	/ \	/ \
x x x	x x-x	x-x
l a k	y h	e ?

b. Spreading

n/a

o-	o-	o-
/ \	/ \	/ \
x x x	x x-x	x-x
l a k	y h	e ?

c. Deletion

o-	o-	o-	o-
/ \	/ \	/ \	/ \
x x x	x x x	x x x	x-x
h i s	i k	m e t	i ?

n/a

Notice that when a floating-x suffix is preceded by a short vowel (see 19 and 36) there will be room in the preceding syllable for incorporating the floating x-slot; thus, spreading will always occur, producing a long vowel as below.¹³

(45)

a. Underlying representation

```
x x x-x x-x x x x
| | | | | | | |
l i t h a m e ?
```

b. Syllabification

```
o- o- o-
/|\ /|\ /|\
x x x-x x-x x x x
| | | | | | | |
l i t h a m e ?
```

c. Spreading

```
o- o- o-
/|\ /|\ /|\
x x x-x x-x x x x
| | | | | / | | |
l i t h a m e ?
```

We have explored the behavior of floating-x suffixes after short vowels and after consonants. Another distributional fact about floating-x suffixes is that they never occur after long vowels. This again raises the question of whether or not the gap is accidental. In this case it seems apparent that the gap is not accidental and has to do with the distribution of morpheme-final long vowels rather than the distribution of floating-x suffixes. An excursus on this distribution follows.

2.2.4 Distribution of Morpheme-final Long Vowels

There are no instances in Broadbent of long vowels followed by floating x suffixes. There are also no instances of long vowels followed by vowel-initial suffixes. In addition, a morpheme ending in a long vowel

is never followed by a morpheme beginning with a CC sequence. (Epenthesis only applies at morpheme boundaries; therefore, such a concatenation would be unsyllabifiable - see Chapter 3.) Given the large number of suffixes ending with long vowels (there are 22 of them), plus the abundance of vowel-initial, floating x, and CC-initial suffixes, this is at first glance a disturbing fact. It turns out, however, that suffixes which end in long vowels are severely restricted in distribution: they can only be (i) word-final, (ii) followed by the sequence CV, or (iii) root final (normally resulting from association to the CVCV: template).

The majority of suffixes ending in long vowels in SSM fall into two major classes: they are personal pronominal suffixes, which are part of the class of final suffixes, or they are postclitics (which Broadbent calls postfixes). In either case, they only occur in word final position.

There are seven suffixes ending in long vowels which occur in non-final position. Four of these occur as the first member of a suffixal combination. Broadbent describes these combinations as follows:

"Certain combinations of verbal suffixes [...] have special requirements as to the shape of the preceding stem, often differing from those of the members of the combination if they occur separately. Many such suffixal combinations consist of one member which is also found under other circumstances, and another which has only been found in association with the first." (p.65)

Three such suffixes are followed by *-nY-*. They are *-e:-nY-/-je:-nY-* 'discontinuative iterative', *-te:-nY-* 'linear distributive' and *-le:-nY-*

an apparently unproductive combination, found in the two forms below.
(These suffixes are discussed in more detail in the following Section.)

(46)

topju-le:-nY- 'rapids' cf. topu:-j- 'to bubble'
TcTju-le:-nY- 'to bubble up' cf. ToTu:-j- 'to foam'

The other suffixal combination containing a long vowel final morpheme is *-hi:-me-* 'predicative'. In each of these cases the suffix ending with a long vowel can only appear in conjunction with *-nY-* or *-me-*, and therefore will always be followed by CV.

Two of the other suffixes ending in long vowels exhibit allomorphy in a manner which guarantees that the long vowel is always followed by a CV-initial morpheme. The andative morpheme *-jik:-* has the allomorph *-a:-/-ja:-* before the imperative modal suffix *-ni-* (thus, this could be seen as suffixal combination *-a:-/-ja:-* is always followed by *-ni-*). The suffix *-?ci-* 'people of (a place)' has the allomorph *-?ci:je:-* which occurs whenever it is followed by a pronominal suffix of non-zero form; all pronominal suffixes begin with CV. Thus, these suffixes as well will always be followed by CV. The suffixes *-a:-/-ja:-* and *-?ci-* are discussed in more detail in the following Section.

There is one suffix, *:-ene:-*, which could conceivably be followed by something other than a CV. The words which Broadbent gives for this suffix are all incomplete (they are missing final suffixes) and she discusses no restrictions on what type of morpheme may follow. It is therefore impossible to tell what might follow *:-ene:-*. I am reasonably certain, however, that this suffix would normally be followed by the

modal suffixes which would fit with the general observations about the restrictions on morphemes with long vowels.

Roots will end in a long vowel when associated to a template calling for a final long vowel (usually the CVCV: template). Suffixes which require such templates have the shape -CV- (such as -nY-/CVCV:) or -C- (such as -t-/CVCV:). These forms will always be syllabifiable.¹⁴

Despite this possible exception, it is clear that the distribution of suffixes ending with long vowels in SSM is restricted primarily to final position. When such a suffix occurs medially, it can only be followed by CV, a sequence which can be syllabified.

2.3 Floating Phonemes

In 2.2.1 above, I discussed suffixes which Broadbent represents as having two allomorphs - one with glottal stop and one without. Examples are -iH- and -ajaHk- which exhibit the allomorphs -?iH- and -?ajaHk- when they are preceded by a vowel, as below.

(47)

hal:ik-iH- 'habitual hunter'

loʔu-ksY-?iH- 'habitual holder'

mola:p-ajaHk- 'mush-makers'

tolti:ja:-nY-?ajaHk- 'tortilla-makers'

I proposed that the alternation was not due to allomorphy but rather to a general rule of SSM which breaks up vowel hiatus by inserting a glottal stop.

There is a set of suffixes in SSM which, like *-iH-*, have alternate surface forms involving the presence or absence of a glottal stop. Unlike *-iH-*, however, they cannot be accounted for by the application of glottal stop insertion. One such suffix is *-te:-*, the first member of the suffixal combination *-te:-nY-* 'linear distributive'. According to Broadbent, it has two allomorphs, *-te:-* and *-?te:-*, as below.

(48)

?e:nup-te:-nY- 'to chase along behind' cf. ?enpu- 'to chase'

ha:lik-te:-nY- 'to hunt along the trail' cf. hal-ki- 'to hunt'

Tyk:y:-nY-?te:-nY- 'to shoot all over along the trail'
cf. Tyk:y:-nY- 'to shoot all over'

hok:-NHe-?te:-nY- 'to come loose gradually' cf. hok:-NHe-
'to come apart'

Another example is the suffix meaning 'people of (a place)' which alternates between *-ci-* and *-?ci:-*:

(49)

?awo:-ni-?ci- 'Yosemite people' cf. ?awo:-ni- 'Yosemite valley'

marpo:sa-?ci- 'they come from Mariposa'

palal-ci- 'people from near Palona'

The difference between these two sets of suffixes is clear. *-iH-* and *-ajaHk-* are both vowel-initial suffixes. If they occur post-vocally an illicit string results which is fixed up by the process of glottal stop insertion. If we assume that the underlying forms of the latter set of suffixes are *-ci-* and *-te:-*, on analogy with *-iH-* and *-ajaHk-*, we cannot explain the surface alternation: being consonant-initial, they

would never result in vowel hiatus and glottal stop insertion would not be applicable. This is demonstrated below.

(50)

a. Underlying representation

```

x x x x x x x x - x x -
| | | | \ / | |   | |
m a r p o s a   c i

```

b. Syllabification

```

o-   o-   o-   o-
/|\  /|\  /|  /|
x x x x x x x x-x x-
| | | | \ / | | | |
m a r p o s a c i

```

c. Glottal Stop Insertion

n/a

* [marpoosaci-]

I propose that in these suffixes the glottal stop is part of the underlying representation of the morpheme and that the alternation is due to the fact that the glottal stop is floating. Thus, I assume the following underlying representations of the suffixes in question:

(51)

```

x x           x x x x x
| |           | \ / | |
? c i       ? t e - n Y

```

The surface alternation results from the process of syllabification, as demonstrated below. (In Chapter 3, I propose a two-level account of syllabification which includes lexical CV(X) syllabification followed by word-level syllabification. As this is not crucial to this particular example, I ignore it for the sake of simplicity. What is vital to this

example is the proposal I make in Chapter 3 that syllabification first syllabifies x-slots and only then incorporates floating phonemes. Floating phonemes which cannot be incorporated into a previously built syllable will delete (they will not induce epenthesis); see Chapter 3 for details.)

(52)

a. Underlying representation

x x x x x x-x x - x x x-x x-	x x x x x x - x x x-x x-
\ / \ / \ /	\ / \ /
T y k y n Y ? t e n Y	? e n u p ? t e n Y

b. Syllabification

o- o- o- o- o-	o- o- o- o-
/ \ / \ / / \ /	/ \ / \ / \ /
x x x x x x x x x x x x-	x x x x x x x x x x x-
\ / \ / \ /	\ / \ /
T y k y n Y ? t e n Y	? e n u p ? t e n Y

c. Incorporation of floating phonemes

o- o- o- o- o-	o- o- o- o-
/ \ / \ / \ / \ /	/ \ / \ / \ /
x x x x x x x x x x x x-	x x x x x x x x x x x-
\ / \ / \ /	\ / \ /
T y k y n Y ? t e n Y	? e n u p ? t e n Y

d. Deletion

n/a	o- o- o- o-
	/ \ / \ / \ /
	x x x x x x x x x x x-
	\ / \ /
	? e n u p t e n Y

Notice that if we syllabify these words, as in 52b, so that all of the x-slots have been incorporated into syllable structure, we find that in the left-hand column there is "room" for the floating glottal stop to be

incorporated as coda into the preceding syllable. I assume that, on being incorporated into syllable structure, floating elements will project an x-slot (this derives from Prosodic Licensing). In the right-hand column, the 'p' of *?e:nup* is already in coda position and there is no room for the incorporation of the glottal stop; it is then Deleted. The analysis thus hinges on the following: if a floating phoneme is incorporated into the syllable (through either Coda or Onset Adjunction) then it will appear in the surface form; otherwise, it will be deleted.

We should compare this to the behavior of a CC-initial suffix such as *-nti-*. Both the *n* and the *t* of *-nti-* must always surface, even when the *n* cannot be incorporated as coda into the preceding syllable. In such a case, epenthesis will occur, allowing the *n* to 'project up' into syllable structure. Examples follow.

(53)

kala:-N-ni-nti-? (B111)
 kalaaNyninti?
 I can dance

jaw:e-j-nti-? (B104)
 jawwejynti?
 it will be my bow

I assume that *-nti-* has the representation in 54, and in 55 I give the derivation of *jawwejynti?*.

(54)

```

x x x
| | |
n t i

```

(55)

a. Underlying Representation

```

x x x x x x-x x x-x
| | \ / | | | | | |
j a w e j n t i ?

```

b. Syllabification (o- projection, onset adj., coda adj.)

```

      o-      o-      o-
     /|\    /|\    /|\
x x x x x x x x x x x
| | \ / | | | | | |
j a w e j n t i ?

```

c. Epenthesis

```

      o-      o-  o-      o-
     /|\    /|\  |\    /|\
x x x x x x x x x x x
| | \ / | | | | | | |
j a w e j y n t i ?

```

d. Resyllabification

```

      o-      o-  o-      o-
     /|\    /|\  /|\    /|\
x x x x x x x x x x x
| | \ / | | | | | | |
j a w e j y n t i ?

```

Notice that epenthesis does not occur to the right of the unsyllabified consonant as one might expect. This is because epenthesis only occurs at morpheme boundaries in SSM. Syllabification and epenthesis are discussed in detail in Chapter 3, and so I will not elaborate here on all of the assumptions entailed in this derivation. (The analysis of *jawwejynti?* is revised in accordance with the two-level account of syllabification proposed therein.) The point that I want to make is that in both the right-hand column of 52 and in 55 there is a consonant

which remains unsyllabified after initial syllabification has applied (? and *n*, respectively). Only in 55, however, does the presence of an unsyllabified consonant trigger epenthesis. In 52, epenthesis does not apply, and the unsyllabified ? does not get projected up into syllable structure. The difference between the two cases is of course that the unsyllabified ? in 52 is floating, while the unsyllabified *n* in 55 is associated to an x-slot.

I propose that SSM distinguishes between phonemes that are floating and phonemes that are not, in the following manner. If a phoneme is associated with an x-slot it must be licensed into syllable structure and will induce epenthesis if it is not otherwise syllabified. If a phoneme is floating, it will be incorporated into syllabic structure via Onset or Coda Adjunction if possible; otherwise, it will be deleted. A floating phoneme will never induce epenthesis. (Recall that SSM also distinguishes between x-slots that are floating and x-slots that are not, as discussed in 2.2.3.)

Notice that the above argument for distinguishing floating phonemes from non-floating phonemes is an argument in favor of a model of phonological representation containing a level of x-slot representation. Thus, both the arguments for floating x-slots in 2.2 and the argument for floating phonemes in this Section provide support for such a model.

Another suffix containing a floating phoneme is an allomorph of the andative suffix *-jik:-*. When this suffix is used with the imperative modal suffix, it has the form *-a:-/-ja:-*.

It is -a:- following consonants and -ja:- following vowels, as below.

(56)

halpa-ja:-ni-: 'go find it!' cf. hal-pa- 'to find'

?yw:y-ja:-ni-: 'go and eat (whenever you want)!' cf. ?yw:y-
'to eat'

he:l-a:-ni-: 'go and fight!' cf. he:l- 'to fight'

?yw:-a:-ni-: 'go and eat now!'

I propose that this allomorph of the andative morpheme has the representation below.¹⁵

(57)

 x x
 \ /
 j a

The alternate surface forms are derived by the process of syllabification, as demonstrated below.

(58)

a. Underlying Representation

```

x x x x x - x x-
| | \ / | \ /
? y w y j a

```

```

x x x x - x x-
| \ / | \ /
h e l j a

```

b. Syllabification

```

o- o- o-
/|\ /| \
x x x x x x x-
| | \ / | \ /
? y w y j a

```

```

o- o-
/|\ /| \
x x x x x x-
| \ / | \ /
h e l j a

```

c. Incorporation of floating phonemes

```

o- o- o-
/|\ /| \
x x x x x x x x-
| | \ / | | \ /
? y w y j a

```

```

o- o-
/|\ /| \
x x x x x x-
| \ / | \ /
h e l j a

```

d. Deletion

n/a

```

o- o-
/|\ /| \
x x x x x x-
| \ / | \ /
h e l a

```

[?ywwyjaa-]

[heela-]

In the left-hand column is the derivation of *?ywwyjaanii* (ignoring the final suffix). The floating consonant is incorporated as an onset in 58c. In the right-hand column is the derivation of *heelaanii*. Here, syllabification adjoins the base-final consonant, *l*, as onset to the final syllable, rather than the floating *j*, even though the floating phoneme is 'closer'. The assumption entailed in this step is that non-floating phonemes have precedence over floating phonemes in syllable-

building processes. Another way of saying this is that x-slots have precedence over phonemes. This is a reflection of the same process by which syllabification first syllabifies x-slots and only afterwards will incorporate floating phonemes where possible (as apparent in the derivation of ?ywwyjaa-). This assumption follows given the distinction we have made between floating and non-floating phonemes. Recall the characterization of this distinction: a floating phoneme must be licensed and will induce epenthesis if not otherwise syllabified; a floating phoneme will be incorporated into syllable structure if possible, otherwise it will delete. Given this distinction, it is not surprising that Onset Adjunction will incorporate the / in 58b (while 'skipping over' the j).

2.4 Alternating Length in Consonants

In the previous two Sections, we have discussed suffixes that cause length in the preceding morpheme and suffixes with an initial consonant that surfaces only in particular concatenations. These have been represented by positing a floating x-slot in the former case and a floating phoneme in the latter. SSM also exhibits suffixes with an initial consonant which alternates on the surface between short and long. These are what I call herein "alternating" consonants. The issue addressed in this Section is the appropriate representation of an alternating consonant.

The Section is organized in the following manner. In 2.4.1 I discuss Broadbent's description of length alternations. Since there is a discrepancy between the data which she presents in the grammar and her description of the data, it is important to establish the actual patterns of alternation and to determine in which ways her description is inaccurate. Section 2.4.2 describes the alternating consonants and establishes that there is in fact a three-way underlying length distinction for consonants. In Section 2.4.3 I develop an account of the underlying representation of alternating consonants. (Alternating vowels are discussed in Chapter 3.)

2.4.1 Broadbent's Morphophoneme //H//

Many morphemes in SSM exhibit systematic alternations in surface forms. For example, the suffix for "allative case" appears in some words as *tto* and in others as *to*; the suffix for "agentive" alternates between *paa* and *pa*, as shown below.

(59)

?oka-tHo-? (B52)
 ?okatto?
 (returning) to the same place

hol:op-tHo-? (B52)
 hollopto?
 in the hole

?ymty-paH-te-? (B112)
 ?ymtypaate?
 I am a good singer

?ymty-paH-h:Y-? (B112)
 ?ymtypahhy?
 he used to be a good
 singer

Broadbent deals with length alternations of this type by positing a morphophoneme, //H//, which follows the phoneme exhibiting the alternation. The morphophoneme has two realizations: it is either

length (which shows up as length on the preceding phoneme) or it is null. Broadbent describes the alternation in the following manner:

"The morphophoneme //H// is phonemically /:/~ /0/. It is zero under the following circumstances: (1) when followed by one consonant followed by any type of juncture; or (2) when followed or preceded by a consonant cluster, except when a morpheme ending //VH// is followed by one beginning //CH//, in which case /V:C/ is found. Otherwise, it is /:/." (p.19)

It is clear, however, from the examples that Broadbent provides throughout the grammar that this description is not accurate. The inaccuracy results, I believe, from two fundamental problems. First is the fact that H is used to represent alternating length of both vowels and consonants although the environments which affect the alternation of consonants is distinct from that of vowels. Second, and more important, is that the description misses what is in fact the generalization about alternation: the alternation depends upon the syllable structure of the string.

As examples, I will describe a number of inaccurate predictions made by Broadbent's formulation of the alternation. First, Broadbent states that //H// will be null (that is, it will not surface as length on the preceding phoneme) if it is "followed by one consonant followed by any type of juncture." Though this is sometimes true it is not always the case. In 60 are two cases of //H// followed by C followed by a morpheme boundary; in both instances the //H// surfaces as length contrary to Broadbent's generalization.

(60)		
?oTki-liHp-tki-?	(B108)	hejaHw-ak:a-t (B60)
?oTkiliipytki?		hejaawakkat
little twin		if you want

The example on the right in 60, *hejaawakkat*, contains a root which ends in the sequence VHC. According to Broadbent's formulation of //H// alternation such roots would never exhibit alternation; the final vowel would always be short. However, if the root showed no such alternation, Broadbent would not have recorded it with an //H// in the first place. Below is an example of such a root showing the alternation.¹⁶ Broadbent discusses many roots of this shape; in each of them the final vowel exhibits alternation.

(61)		
hikaHh-a-?-hY:	(B52)	hikaHh-N (B51)
hikahmy?hyy		hikaahyN
from his deer		the deer's

This is also the case with the suffix *-Hs-*, in which the //H// is followed by a C followed by a morpheme boundary and therefore should show no alternation. Again, if there were no alternation, Broadbent would not have utilized the //H// in the morphemic representation of this suffix. An example of the alternation involved follows (note that, since the //H// is morpheme-initial, the length will be realized on the final phoneme of the preceding morpheme).

(62)		
?i-Hs-?ok	(B131)	jaw:e-Hs-?-hY: (B54)
?is?ok		jawweesy?hyy
[??]		with his bow

It is important to note that although Broadbent's formulation of the alternation is inaccurate, the alternations actually detailed in the

grammar are entirely consistent and are so in a way which is dependent on syllabification. The surface realization of an alternating consonant depends on the syllabification of the preceding phoneme in a manner to be described in this Section. The surface realization of an alternating vowel depends on the syllabification of the following phoneme in a manner to be described in Chapter 3. The surface realization of a morpheme-initial 'H' depends upon the syllabification of both the preceding and following phonemes as described in 2.2.3.

I will continue to use Broadbent's notation despite the problems pointed out here. I am not conceiving of 'H' as a morphophoneme in the sense of Broadbent, however. It is best to think of the 'H' as a notational device which signals that the preceding phoneme is "alternating". In other words, it is a notation designating the length class of the preceding phoneme and thus is entirely analogous to ':', a notational device which designates that the preceding phoneme is "long."

The problems that Broadbent had in describing the alternation phenomena clearly result from the conception of phonology held at that time. An accurate description of the alternation facts is impossible in a linear model of phonological organization. Given the constraints of the framework within which she worked, Broadbent's treatment of length in SSM is remarkably insightful.

2.4.2 Distinctive Length in Consonants

An alternating consonant (CH) surfaces as a geminate if it is preceded by CV; it surfaces as short if it is preceded by CVV or CVC. Thus, the morpheme which Broadbent writes *-kHu-* is one which on the surface alternates between *kku* and *ku*, as shown below.

(63)

-kHu-

?unu-kHu-ni-? (B58)

?unukkuni?

bring it!

?etal-kHu-na-: (B81)

?etalkunaa

he took him back

wi:-kHu-n-ti: (B58)

wiikuntii

let's take him

In the left-hand column, *-kHu-* is preceded by a CV sequence and surfaces as the geminate *kku* in *?unukkuni?*. In the right-hand column are examples showing *-kHu-* preceded by a CVC and CVV sequence. In both cases it surfaces as the non-geminate *ku*.

Further examples of alternating consonants follow.

(64)

-tHo-

?oka-tHo-? (B52)

?okatto?

(returning) to the same place

hol:op-tHo-? (B52)

hollopto?

in the hole

hu:ki-tHo-?-hY: (B52)

huukitto?huu

on his tail

wakaHl-tHo-? (B52)

wakalto?

to the creek

(65)
-NHe-

?yw:y-NHe-haHk-to-? (B101)
?ywwyNNeHakto?
to the feast (allative)

peHt-NHe-?-ko: (B56)
petNe?koo
their hiding

?ese:l-NHe-?:a-ci-?-hY: (B119)
?eseelyNNe??aci?hy
his birth

helaHj-NHe-haHk (B101)
helaJNehak
being afraid

(66)
-hHi-

hyjNe-hHi-koH (B103)
hyjNehhikoo
you can see them

cyTeN-hHi-koH (B102)
cyTeNhhikoo
they taste good

As we can see, when the CH sequence is preceded by a light syllable, the C geminates (which serves to make the preceding syllable heavy). When the preceding syllable is heavy, no gemination occurs. Note that if gemination were to occur in the cases on the right it would result in an unsyllabifiable string and epenthesis would then be necessary.

Below is a list of suffixes with alternating consonants. Though this is a relatively small number of suffixes, they occur fairly frequently in SSM words. (The first three are the allomorphs of the causative suffix.)

(67)

-kHu-

causative

-nHu-

causative

-nHuk:u-

causative

-hHi-

intensifier

-tHo-

allative case

-tHuH-

reventive

-NHe-

passive;mediopassive

-pHuTe-

"kind, species"

Alternating consonants are found only in suffix-initial position. This restriction is the natural result of their character: it is the only position in which such an alternation could occur. Since the alternation is based on the (syllabification of the) preceding string, if an alternating consonant were to occur in medial or final position it would not show any surface alternation as the preceding string would be fixed. This observation leads to the question of whether alternating and long consonants are truly distinctive. (Recall that we have already established, in 2.1 above, that short and long consonants are distinctive in SSM.)

Suppose that consonants in SSM are of one of two underlying types: they are either short or they are alternating. An alternating consonant is one which geminates when preceded by a short vowel. This would account for all of the short consonants in SSM, as well as all of the morpheme-initial alternating consonants and the medial and final surface geminates. Though this would be a far simpler approach than the one we are forced to adopt, it fails for the following reason: SSM exhibits morpheme-initial geminates, whose behavior is distinct from morpheme-initial alternating consonants. Broadbent discusses 15 suffixes with initial geminates, listed in 68.

(68)	
-h:Y-	past
-c:Y-	diminutive
-c:i:-	second person plural
-m:-	ablative case
-t:i-	diminutive plural
-t:Y-	directional
-j:-	iterative
-j:a-	plural
-p:u:-	third person plural
-p:a-	[meaning obscure]
-N:-	genitive case
-c:-e-	habitual
-m:a-	"one who (has or does something) to excess"
-?:YniH-	possessive
-c:-	static

Below I give examples of a long consonant and alternating consonant, each in morpheme-initial position, using the morphemes *-N:-* and *-NHe-* respectively. In the left-hand column the morpheme in question is preceded by the sequence CV; in the right-hand column by the sequence CVC.

(69)

a. long consonant *-N:-*

?ajtuH-me-N:-j (B51)
 ?ajtuumeNNyj
 all of us (acc.)

?is:ak-N:-? (B51)
 ?issakyNNy?
 it is his

b. alternating consonant *-NHe-*

?yw:y-NHe-haHk-to-? (B110)
 ?ywwyNNeHakto?
 to the feast (allative)

helaHj-NHe-haHk (B101)
 helajNehak
 being afraid

As we can see, the long consonant surfaces as long in both cases, which causes epenthesis in the position preceding the geminate in *?issakyNNy?*. The alternating consonant surfaces as long in the left-hand case and as short in the right-hand case (thereby avoiding the need for epenthesis).

The distinction between C: and CH is also apparent in their behavior following an alternating vowel (VH). (Alternating vowels are discussed in detail in Chapter 3.) The sequence VH-C: always surfaces as VCC (below left), while the sequence VH-CH always surfaces as VVC (below right).

(70)		
cukuH-?:YniH-te-? (B118)		niToH-tHo-?-hY: (B52)
cuku??uniite?		niTooto?huu
I have a dog		in his nose
koT-:u-maH-h:Y-? (B122)		?u:cuH-tHo-?-nY: (B52)
koTTumahhy?		?uucuuto?nuu
old broken thing		to your house

Thus we can see the distinctions between long and alternating consonants in the following patterns:

- (71)
- (i) CVC + C: → CVCyCC (see 69a)
 CVC + CH → CVCC (see 63 - 66)
- (ii) VH + C: → VCC (see 70)
 VH + CH → VVC (see 70)

It is clear that there is a three-way length distinction in consonants in SSM. Consonants are either short (C), long (C:), or alternating (CH). It is also clear that the distinctions in consonant length must be lexically represented. This is reinforced by the near minimal sets in 72 and the minimal pairs in 73.

(72)
 -hHi- intensifier
 -h:Y- past
 -hY:- third person singular

-pHuTe- "kind, species"
 -p:u:- third person plural
 -pu- [meaning obscure]

(73)
 -tHo- allative case
 -to- directional

-p:a- [meaning obscure]
 -pa- involuntary passive
 (followed by -ksY-)

2.4.3 The Representation of Alternating Consonants

Having determined that the alternating consonants are in fact distinct from both underlying short and long consonants we must now address the question: What is the representation of an alternating consonant? Recall that I have represented the distinction between short and long consonants in terms of the relationships between phonemes and x-slots. A short consonant consists of a (consonantal) phoneme singly linked to an x-slot; a long consonant consists of such a phoneme doubly-linked to adjacent x-slots, as shown below.

(74)

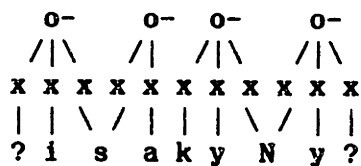
short consonant:	long consonant:
x	x x
	\ /
p	p

The figures in 74 show the underlying representations of a short and long consonant; note, however, that the surface representation is identical to the underlying one. This is because (i) underlying short consonants always surface as short and underlying long consonants as long and (ii) an x-slot is defined, in part, as a unit of length, and in surface representation depicts the length and linear ordering of a phonological string. As an example, the underlying representation of the morpheme *-N:-* is given in 75. In 76 is the surface representation of the word *?issakyNNy?* (*?is:ak-N:-?*, see 69b), showing the effects of syllabification (including two applications of epenthesis).

(75)



(76)



In both its underlying form and in the surface form of the word *?issakyNNy?*, the geminate *-N:-* is represented by the phoneme, *N*, doubly-linked to adjacent x-slots.

Though this might appear to be an obvious point, I bring it up precisely because it is not the case for the alternating consonants. Since the alternating consonants are distinct from each of the short and long consonants, we must assume that the underlying representation of an alternating consonant is distinct from each of the representations in

74. The surface representation of an alternating consonant, however, will be either short or long; that is, it will have one or the other of the representations in 74.

What is needed, then, is a representation which is distinct from both of those in 74, but which in the course of the derivation (specifically, syllabification) will produce one or the other of the representations in 74.

I propose that an alternating consonant contains both a floating x-slot and a floating consonant. The two distinct surface alternations are derived by the process of syllabification. To see this, let us examine the derivation of the two alternate forms of *-tho-*. The underlying representation of *-tho-* is given in 77 and the derivations in 78.

(77)

x λ
|
t o

(78)

a. Underlying Representation

```

x x x x - x x - x
| | | |   |   |
? o k a   t o   ?

```

```

x x x x x x - x x - x
| | \ / | |   |   |
h o l o p   t o   ?

```

b. Syllabification

```

  o-  o-   o-
  /|  /|   /|\
x x x x - x x x
| | | |   | |
? o k a   t o ?

```

```

  o-   o-   o-
  /|\  /|\  /|\
x x x x x x - x x x
| | \ / | |   | |
h o l o p   t o ?

```

c. Incorporation of floating phonemes

```

  o-  o-   o-
  /|  /|\  /|\
x x x x x x x x
| | | | \ | |
? o k a   t o ?

```

```

  o-   o-   o-
  /|\  /|\  /|\
x x x x x x x x x
| | \ / | | | | |
h o l o p t o ?

```

d. Spreading

```

  o-  o-   o-
  /|  /|\  /|\
x x x x x x x x
| | | | \ | |
? o k a   t o ?

```

n/a

In 78b, the floating x-slot is incorporated as onset. Recall that this step was argued for in 2.2.1 above for suffixes with a pre-vocalic floating x-slots, such as *:-a-*. In 78c, in the left-hand column, Coda Adjunction incorporates the floating phoneme (which projects an x-slot) as coda of the second syllable. In the right-hand column, the root-final consonant has been incorporated into the coda and there is no room for the *t* which remains floating. This step was argued for in 2.3 above for suffixes such as *-?ci-* which have an initial floating phoneme. In

the last step, in *?okatto?*, the *t* spreads onto the empty x-slot. In *hollopto?* the floating 't' is associated to the empty x-slot.

As we can see from the above, the surface alternations can be derived from the underlying representation that I have proposed by the process of syllabification. No special lengthening or deletion rules are needed. Each step of the derivation in 78 has been independently supported elsewhere in this Chapter. By utilizing floating x-slots and floating phonemes in the manner advocated herein, we are able to describe the complex array of lengthening phenomena and consonantal alternations exhibited by SSM.

2.5 Appendix

Hayes (1989) (henceforth H89) argues that segmental theories of prosodic organization (i.e. CV and X theory) cannot account for the array of compensatory lengthening (CL) processes. In fact, he argues, "when such theories are beefed up sufficiently to handle the full range of CL types, they reduce to something like the claim that any segment can lengthen to compensate for the loss of any other segment" (p.254). Given the evidence presented herein in support of a segmental model of prosodic organization, it behooves us to examine Hayes' claim in more detail.

Hayes points out that CL is subject to a number of prosodic constraints. These constraints apply in two ways: they determine (i) which deleted segments can trigger CL, and (ii) which neighboring segments can

lengthen compensatorily. Hayes claims that these constraints are guided by a prosodic frame, and that this frame is of the kind provided by a moraic model of prosodic organization. For example, the fact that onset segments do not trigger CL upon deletion is reflected in the fact that onsets have no prosodic "position" in a moraic theory.

H89 examines the various patterns of CL from the perspective of both segmental and moraic theories. The complex patterns, he argues, necessitate various expansions in the segmental theories that render them useless in accounting for the range of attested CL cases. As he states: "[t]his somewhat detailed section is crucial to the argument: the aspects of CL that I propose to explain through the notion of prosodic frame might also be explained by limiting the possible melody-to-skeleton associations permitted in segmental prosodic theories. What I will show is that no such limitations are tenable" (p. 255).

I will argue herein that the rather detailed argument which H89 constructs against segmental theories is based on a false interpretation of the nature of deletion. In fact, given Hayes' own rule of Parasitic Delinking, as detailed below, such theories can not only handle the variety of CL cases without undue expansions but can also rule out CL through onset deletion.

Let us first look at the pattern that Hayes calls CL by vowel loss: VCV → V:C∅. In this pattern, a vowel is deleted (usually a final vowel), and the vowel of the preceding syllable is lengthened. Hayes demonstrates this pattern with a well-known sound change from Middle

English, in which deletion of a final schwa triggers lengthening of the penult, [talə] → [ta:l], Modern English *tale*.

Hayes provides the following analysis.

(79)

a. Input

```

      o-  o-
     /|  /|
    O N O N
    | | | |
    X X X X
    | | | |
    t a l ə
  
```

b. Schwa Drop

```

      o-
     /|
    O N
    | |
    X X X X
    | | |
    t a l
  
```

The input is given in 79a, the result of Schwa Drop in 79b. The second syllable and its intermediate structure has been eliminated in 79b though the x-slot count remains the same. This is the result of Hayes' principle of Parasitic Delinking, given below.

(80)

Parasitic Delinking

Syllable structure is deleted when the syllable contains no overt nuclear segment.

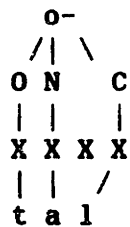
Parasitic Delinking is utilized in both segmental and moraic accounts of CL. As Hayes notes, it is a most plausible assumption, given the following propositions: (i) no well-formed syllables in any language

lack a nuclear element on the surface, (ii) the nuclear vowel is the only obligatory element of the syllable in all languages, and (iii) it is the core to which other segments are syllabified by adjunction (p. 268).

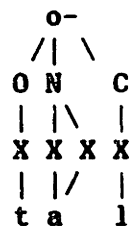
At this point in the derivation, it is necessary to posit a rule of "Flop", which attaches the 'l' onto the final x-slot, as in 81a. The final form is obtained by spreading the vowel onto the adjacent x-slot, left empty by Flop, as in 81b.

(81)

a. Flop



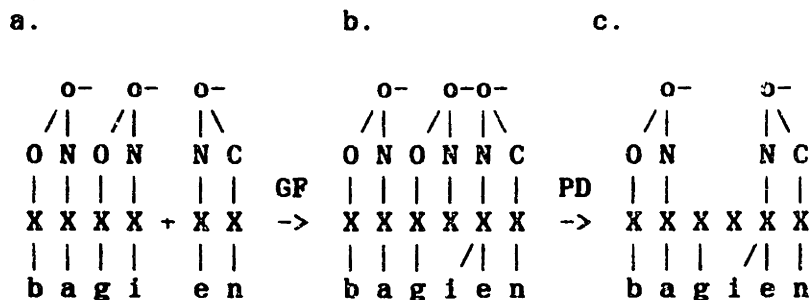
b. Spreading



Let us turn now to the pattern of CL from Glide Formation. Hayes illustrates this pattern with data from Ilokano.¹⁷ For a complete description of the Ilokano facts, I refer the reader to H89; here, I will be concerned only with Hayes' X-theory analysis of the derivation /bagi + en/ -> [baggyen].

In order to express the lengthening of /g/ as compensatory, the rule of Glide Formation must leave a vacant slot to the right of this segment. Hayes' GF rule delinks the melody of a nonlow vowel and reattaches it to the x-slot of a vowel on its right. In 82, we see the result of Glide Formation. Since the delinking operation in Glide Formation leaves the second syllable with an empty nucleus (82b), Parasitic Delinking automatically applies and removes this syllable and its structure (82c).

(82)



Compensatory Lengthening then spreads the consonant onto the adjacent X slot vacated by Glide Formation as in 83a.¹⁸ Syllabification, which H89 assumes is an everywhere process, applies to fix up the ill-formed 83a, resulting in the surface 83b.

(83)

a. Application of CL

b. Syllabification



H89 states that in order to handle CL of the type found in Ilokano, X theory "must allow long segments to be linked to x-slots that originally were syllabified as onset + nucleus" (p.278) as in 82. To handle CL in

Middle English "it must allow onset consonants to flop onto X positions originally syllabified as nuclei" (81c) and "allow vowels to lengthen by spreading onto former onset positions" (81b). H89 views these moves as "extensions" that "subvert the main principles that have previously constrained the power of X theory" (p. 279).

H89's use of the words "originally syllabified as" and "former" is problematic. In each of these allegedly subversive relinkings, an element of the melody spreads to an adjacent x-slot that is prosodically unaffiliated, its syllabic structure having been deleted through the process of Parasitic Delinking. Given that at the time of spreading the former associations of these x-slots are no longer present in the derivation, and that syllabification automatically applies to the results of spreading to form new syllabic associations, I conclude that the former prosodic status of prosodically unaffiliated x-slots is irrelevant. To claim otherwise would be to imply some sort of "prosodic memory" that constrains association.

Let's examine H89's argument more closely. He states:

"Such extensions have serious consequences, in that they subvert the main principles that have previously constrained the power of X theory: (a) double linking to onset + nucleus, if they exist, do not represent length; (b) length-creating operations involve only spreading onto rhyme positions. With these gone, the theory comes close to maintaining that any segment can lengthen to compensate for the deletion of any other." (p. 279)

Notice that in the derivation of *baggyen* (82 and 83) at no point is there a double linking to onset and nucleus. Instead, what we find is (1) delinking of syllabic structure triggered by reassociation of the

nuclear vowel, (ii) spreading to a neighboring, unaffiliated x-slot and (iii) syllabification, which results in a long consonant being linked to a coda and following onset. None of these operations necessitates any expansion of the principles of association inherent in X-theory.

In order to see the point more clearly, let us turn to the asymmetries which Hayes points out in CL. Although the range of CL patterns is impressive, there are a number of conceivable patterns that apparently do not occur. As Hayes rightly assumes, the theory should be able to rule out the non-occurring patterns as well as account for the occurring ones.

One such asymmetry is the lack of CL triggered by the deletion of onset consonants. Notice that in the CL patterns described above, the trigger is in all cases the deletion of an element of the rhyme. There is no example of VCV → V:OV where C is an onset. Hayes' claims that such a case can be derived using X-theory, and he gives the following derivation.

(84)

a. Input	b. [s] → 0	c. CL
o- o-	o- o-	o- o-
/	/	
N O N	N O N	N N
		\
X X X	X X X	X X X
		/
o s a	o a	o a

Again, let us consider Hayes' description of the problem:

"The crucial part of the derivation is [84c], where spreading onto a former onset position creates length. The only mechanism in X theory to exclude this possibility is to

add constraints concerning what linkages are possible, and which ones count as length-creating. In section 4, however, I argued that such constraints are untenable: in particular, sequences formerly syllabified as onset + nucleus may appear as surface long segments, and vowels may spread onto former onset segments to create length." (p. 284)

H89 fails to note, however, that 84 is crucially different from 79 and 82-83 in that Parasitic Delinking does not occur in 84 because the nucleus is not deleted. Thus, at the point in the derivation when spreading applies (that is, to the representation given in 84b) we are spreading not onto a "former" onset position but onto an actual onset position. Furthermore, it is a standard assumption of X-theory that the types of segments that may project up to a syllable, and which may be adjoined as onset or coda are regulated by universal and language-specific constraints. These independently necessary constraints prevent the empirically unattested spreading depicted in 84c.

In short, H89 argues that in order to derive the occurring patterns of CL we must expand X-theory to allow various types of relinking, and that in order to rule out CL through onset deletion we must constrain precisely these relinkings. There is, however, no need for any such expansion. Where Parasitic Delinking applies, it results in prosodically unaffiliated x-slots to which association is unconstrained. Where it does not apply, association is governed by the independently motivated prosodic constraints on syllabification in the language.

-- Notes --

1. The exception is Deletion, which applies as the last step of a derivation and deletes any unsyllabified material. Deletion is independently supported by evidence from the templatic system in SSM. See Chapters 3 and 4.

2. Hayes makes two separable arguments in the paper - (i) that moraic models naturally account for the fact that compensatory lengthening is only found in languages that have a weight distinction (since weight distinctions are not expressed in x-models) and (ii) that x-models are incapable of accounting for the array of compensatory lengthening phenomena found in natural language. I will argue against the second point.

3. Note that I have not given the gloss for *hanna?mahhi*. This is because the word has not been translated individually but as part of a sentence. In such cases, I will not attempt to determine the part of the sentence gloss which corresponds to the word in question but will notate it as [??]. Readers may refer to Broadbent for a full transcription.

4. Recall that 'H' is a notation which signifies that the preceding phoneme is "alternating" - one that will surface as long in certain environments. See Section 3.4 below.

5. For the purposes of this derivation, I will treat the suffix -*eH-* as a short vowel, -*e-*. See Chapter 3 for the representation of alternating vowels.

6. SSM provides many arguments against a moraic model of prosodic organization. See Sections 2.2 and 2.4 for evidence in favor of floating x-slots; Sections 2.3 and 2.4 for evidence in favor of floating phonemes; Section 4.4 for evidence supporting both x-slots and the Nucleus node.

7. Some of the suffixes which have the shape -:V(X) are template-providing suffixes; that is, they immediately follow the root and determine the shape which the root will take. For example, -:*e-* selects a CVCVC template. The final C of the root is lengthened. The question which naturally arises is whether or not the morpheme-initial length posited by Broadbent is actually a property of the template. In other words, the same result would be derived in this case if the suffix were -*e-* and it took a CVCVCC template. Two potential problems with such an account come to mind: (i) in general, there is no spreading in SSM in association to templates; empty templatic positions are filled with an epenthetic consonant or vowel and (ii) such a template is difficult to represent as a unit of prosodic structure. A better reason, perhaps, to assume that the gemination is represented on the suffix, is on analogy with suffixes such as -:*a-* and -:*me?*- which are not template-providing suffixes, yet cause gemination of the final phoneme of the preceding morpheme. In this case, and the others like it, we can not assume that the gemination is part of the specification of a template selected by the suffix in question.

8. Recall that the epenthetic vowel /Y/ is also an underlying vowel in SSM. As pointed out in McCarthy (1989), this is inconsistent with

radical underspecification. We can assume then that epenthesis inserts both an x-slot and associated phonemic content. For a featural analysis of the vowel /Y/ in SSM see McCreight (1985).

9. In 29 above, I have replaced Broadbent's morphemic representation $-?:a-$ with $-:a-$ in accordance with my analysis. Similarly, the form which she writes $le:le:-nY-?:a-$ I interpret as $le:le:-nY -:a-$. Though Broadbent does not give the surface form for this word we can assume that it is $*[leeleeny??a-]$. I will use the latter form in the derivations below only because it is much simpler than the derivation of $?eseelyNNe??aci?hyy$ (see 29), which involves an alternating consonant and epenthesis in addition to the long glottal stop.

10. The suffix $-HmetiH-$ begins with an 'H' and ends with an alternating vowel ('iH'). Alternating vowels are discussed in Chapter 5; here, I will ignore the behavior of the suffix-final vowel. Also, note that the underlying sequence ij always surfaces as ii .

11. I am assuming that the initial floating x-slot of $-:e-$ is incorporated into the following syllable as an onset. I argue in Chapter 3 that this incorporation occurs at the word-level. For our purposes here, the important thing to note is that, in the case of $lakyhhe?$, there is "room" in the following syllable for the floating x-slot to be incorporated; in the case of $hissikmeti?$ there is no "room" in either the preceding or the following syllable for incorporation of the initial floating x-slot of $-HmetiH-$.

12. Spreading is also subject to the constraints on syllable structure in the language; thus, a vowel cannot spread onto an x-slot which is syllabified as an onset.

13. The incorporation of the floating x-slot takes place during word-level syllabification; see Chapter 3 for details.

14. For example, when the latter is followed by a C-initial suffix, as in $hywa:-t-ma:$ (see 25), epenthesis will apply at the morpheme boundary resulting in $hywaatymaa$. See Chapter 4 for details on the CVCV: template and Chapter 3 for an analysis of epenthesis.

15. Note that $/?/$ is not the only floating segment in SSM. There are at least two suffixes exhibiting a floating $/j/$ (as in $-a:--/ja:-$) and two with a floating $/w/$. In addition, I argue in Section 2.4 that the representation of alternating consonants contains a floating phoneme - these include floating $/t/$, $/k/$, $/p/$, $/n/$, $/N/$ and $/h/$.

16. These root alternations are not the result of templatic considerations. The final vowel of a root is considered to be alternating if such vowel exhibits alternation when suffixed by non-template-providing suffixes. In the templatic phonology, underlying length distinction have no affect; thus, neither $//H//$ nor $:'$ will affect template shape. This is presumably because the presence of a template "overrides" the underlying structure of a root, allowing only the phonemic tier to be visible for association. This issue is discussed in Chapter 4.

17. The Ilokano data are similar to Siever's Law in IE; see Dresher and Lahiri 1991).

18. This rule applies to some consonants and not to others; refer to H89 for an exact formulation of the CL rule.

Chapter 3

Syllabification and Epenthesis

An examination of syllabification in SSM leads to an interesting contradiction. On the one hand, it can be demonstrated that syllabification must apply at the word-level in order to account for the surface variation in alternating vowels. On the other hand, in order to explain the distribution of epenthesis, syllabification must arguably take place prior to the word level. I propose a solution to this dilemma by arguing that syllabification in SSM takes place at two discrete stages, at the level of the morpheme and at the level of the word.

The Chapter is organized in the following manner. Section 1 discusses the distribution and representation of alternating vowels, and establishes that vowel length can only be correctly derived if syllabification occurs from right-to-left and non-cyclically. In Section 2 I propose my analysis of syllabification in SSM which involves a two-level approach. Partial syllabification applies at the lexical level. Subsequent word-level syllabification builds syllables from right-to-left, respecting previously built structure and the principle of Maximality. Section 3 discusses Prosodic Syllabification, as proposed

by Ito, and demonstrates that such an approach cannot correctly derive the SSM facts. This results from two (potentially) problematic aspects of SSM syllabification: (i) although syllabification must not apply cyclically, there are certain cyclic effects observed and (ii) epenthesis can only occur at morpheme boundaries even though these boundaries are not visible at the point in the phonology where syllabification occurs. These effects fall out of the analysis that I propose herein.

3.1 Alternating Vowels

It is impossible to describe syllabification and epenthesis in SSM without having a thorough understanding of the behavior of alternating vowels. I therefore begin this Chapter with an examination of the distribution, surface alternations and representation of alternating vowels.

In the previous Chapter, we looked at alternating consonants. SSM also exhibits alternating vowels. An alternating vowel is one which alternates between long and short in surface forms in a predictable way, and is notated by a vowel followed by the morphophoneme 'H'. The suffix, *-peH-* contains an alternating /e/ and has two surface variants - *pe* and *pee* - as shown below.

(1)
~~-peH-~~

liwa?-peH-h:Y-?-koH (B113)	liwa?-peH-te-?-koH (B113)
liwa?pehhykoo	liwa?peete?koo
he used to make speeches for them	I am their speechmaker

There are at least 26 suffixes in SSM with alternating vowels. Note that alternating vowels are restricted to the following positions: they occur (i) morpheme-finally or (ii) followed by a single morpheme-final consonant. Reasons for this restriction will be discussed in 3.1.2. Further examples of suffixes with alternating vowels follow.

(2)
-eH-

?u:k-eH-Nko? (B61)	?u:k-eH-ti: (B60)
?uukeNko?	?uukeetii
...so that I can come in	let's go in!
hywa:-t-eH-? (B37)	?eca:-t-eH-nih (B60)
hywaate?	?ecaateenih
run!	let him go with him
?yn:-eH-?-hY: (B60)	wel-h-eH-tic:i: (B48)
?ynne?hyy	welheeticci
if he comes	let's look for it

(3)
~~-paH-~~

?ymty-paH-h:Y-? (B112)	?ymty-paH-te-? (B112)
?ymtypahhy?	?ymtypaate?
he used to be a good singer	I am a good singer
lile-nHi-paH-t-?ucaH-te-? (B117)	cini-nHi-paH-te-?-koH (B112)
lilennipat?ucaate?	cininnipaate?koo
I live upstairs	I'm the smallest of them

(4)
-liHp-

?oTki-liHp-koH (B108)
?oTkilipkoo
they are twins

?oTki-liHp-tki-? (B108)
?oTkiliipytki?
little twin

(5)
-haHk-

mul-h-haHk (B101)
mulhuhak
stopping

cam-h-haHk-j (B101)
camhyhaakyj
dying (acc.)

halik-meh-nY-haHk-te-? (B101)
halikmehnyhakte?
I was hunting on my way

Alternating vowels are also exhibited in roots. Examples follow.

(6)
haja:puH-

haja:puH-j-ni-? (B104)
hajaapujni?
you will be a chief

haja:puH-ni-? (B48)
hajaapuuni?
you are a chief

(7)
ta:ciH-

ta:ciH-mhi-ko: (B110)
taacimhikoo
they are brothers

ta:ciH-ni-?-kan (B91)
taaciini?kan
you are my brother

(8)
hikaHh-

hikaHh-m-?-hY: (B52)
hikahmy?hyy
from his deer

hikaHh-N (B51)
hikaahyN
the deer's

The above examples show roots with alternating vowels in combination with non-template-providing suffixes. It is only with such suffixes that the alternations appear. Alternating vowels have no effect on

templates when such roots occur with template-providing suffixes. For example, the root *ta:ciH-* alternates between *taaci* and *taacii* when combined with non-template-providing suffixes as in 7. When combined with the suffix *-puH-*, however, the root associates to the CVCCV shape required by the suffix (the C₃ position is filled by 'j', an idiosyncratic property of this suffix) to form *tacji-puH-* 'half brother, older than Ego'.

As another example, I list below some of the entries given in Broadbent's dictionary for the root *li:leH-*:

(9)	
<i>li:leH-</i>	(1) high (2) up
<i>lile-nHi-pa-</i>	(1) uppermost (2) upstairs
<i>lile-t</i>	higher up
<i>lile-t:Y-t</i>	upwards
<i>lile:-h-</i>	to raise, tr.
<i>lil:e-ka-</i>	higher
<i>lil:e-ka-c:Y-n</i>	a little bit higher
<i>lil:e-m-?ucaH-</i>	(1) the top (2) the upper part
<i>lil:e-m:-?</i>	on top
<i>lileH-to-</i>	(1) above (2) heaven
<i>lileH-to?-hY:</i>	above him
<i>lileH-?</i>	outside hands! (handgame call): "on top"

The examples show *li:leH-* in combination with suffixes requiring the templates CVCV, CVCV: and CVC:V, as well as with the non-template-providing suffixes *-to-* and *-?*. Before the suffix *-?*, the alternating vowel surfaces as short (*liile?*); when followed by *-to-* it surfaces as long (*liileeto?hyy*). The shape CVVCVV which we find in the word *liileeto?hyy* (as well as in *taaciini?kan* in 7) does not occur as a template shape in SSM, nor does it occur as the underlying form of any

root - it only occurs when a root of the shape CV:CVH is followed by a non template-providing suffix of the shape -CV(X)-.

3.1.1 Distinctive Vowel Length

As is the case with the consonants, vowels in SSM exhibit a three-way underlying length distinction. A vowel may be either short, long or alternating in underlying representation. On the surface, vowels are either long or short.

This three-way distinction is demonstrated in 10, which compares short, long and alternating /a/ - a, a: and aH - in morpheme-final position, represented by the morphemes *kel:a-* 'snow', *hywa:* 'run' and *-paH-* 'agentive', respectively. In the left-hand column the morpheme in question is followed by the sequence CV; in the right-hand column by CCV.

(10)

short a (a)

kel:a-na-me? (B63)
kellanaame?
 it snowed on us

kel:a-?-hY: (B56)
kella?hyy
 snowing

long a (a:)

hywa:-t-ak (B37)
hywaatak
 I ran just now

hywa:-t-ma: (B36)
hywaatymaa
 I am running

alternating a (aH)

hel?y-paH-te-? (B112)
hel?ypaate?
 I am a good fighter

lile-nHi-paH-t-?ucaH-te-?
 (B117)
lilennipat?ucaate?
 I live upstairs

As we can see, the three types of vowels exhibit distinct patterns. The underlying short vowel remains short in both cases. The underlying long vowel surfaces as long, even in the case in the right-hand column, which causes the word to be unsyllabifiable without the application of epenthesis. The underlying alternating vowel surfaces as long in the left-hand column. In the right-hand column, it surfaces as short, thereby making epenthesis unnecessary in this form. The environments in which an alternating vowel will surface as long or as short are discussed in 3.1.2 below.

Further evidence of the distinctiveness of these three underlying vowel lengths is found in the following list of suffixes which form minimal pairs/sets with respect to vowel length.

(11)		
-ja-	iterative	
-ja:-	andative	
-jaH-	[meaning obscure]	
-a-	simultaneous gerundial	
-a:-	andative	
-aH-	predicative; nominalizer	
-ma-	agentive	
-ma:-	first person singular	
-maH-	passive participial (preceded by -:u-)	
-pu-	[meaning obscure]	
-puH-	step-(relative)	
-me-	first person plural	
-meH-	habitual	
-pa-	involuntary passive (followed by -ksy-)	
-paH-	agentive	
-e:-	discontinuous iterative (followed by -nY-)	
-eH-	present imperative	
-jak-	"times ten"	
-ajaHk-	plural agentive	

The representations of a long and short vowel are as follows:

(12)	short:	long:
	x	x x
		\ /
	v	v

Alternating vowels must be distinct from both short and long vowels in underlying representation. On the surface, however, an alternating vowel will be either short or long. It is necessary to posit a representation which is distinct from those in 12, but from which either of the representations in 12 can be derived. I will represent

In 15a, the alternating vowel surfaces as short and is closed by the root-final consonant. In 15b, the alternating vowel surfaces as long. The root-final consonant is syllabified as the onset of the following syllable.

Notice that you cannot predict the syllabification of the alternating vowel from the string which precedes it. In 14, the alternating vowel is in each case preceded by CVC. If syllabification applied from left to right, it would not be possible to derive the distinct surface patterns of the alternating vowels.

Left-to-right syllabification would syllabify the roots in 14 identically. It could syllabify the alternating vowel as long, leaving the root-final consonant free to form an onset with the following syllable, as shown below, which would result in an incorrect syllabification of *hikahmy?hyy*:

(16)

*	o-	o-	o-	o-
	/	/ \	/	/ \
	x x x x x x		x x x x x x	
	h i k a h		k u t e w	

Alternatively, the alternating vowels could be syllabified as short, which would lead to an incorrect syllabification of *kuteewyNkythoj*:

(17)

	o-	o-	*	o-	o-
	/	/ \		/	/ \
	x x x x x x			x x x x x x	
	h i k a h			k u t e w	

Left-to-right syllabification cannot distinguish between the words in 14 because the surface variants of alternating vowels can only be determined by examining the string of phonemes which follows an alternating vowel.

To see this, let's examine the distribution of the long and short surface variants of alternating vowels. In 18 - 22 below I group words with alternating vowels according to the number of non-prevocalic (i.e. unsyllabifiable) consonants which follow such vowels. (Note that any prevocalic consonant will automatically be syllabified as the onset to the following vowel. In the strings VHCCV and VHC#, the alternating vowel - VH - is in each case followed by one unsyllabifiable consonant.) As we can see, an alternating vowel surfaces as short if it is followed by an odd number of unsyllabifiable consonants; otherwise, it surfaces as long.

(18)

Alternating vowel followed by zero unsyllabifiable consonants

(either VHCV(X) or VH#): vowel surfaces as long.

a.

cyt:yp-jaH-ji-? (B104)

cyttypjaaji?

it will be dark

b.

haja:puH-ni-? (B48)

hajaapuuni?

you are a chief

c.

hejaHw-ak:a-t (B60)

hejaawakkat

d.

je?pa-tkuH-ha-: (B86)

je?patkuuhaa

e.

keNke-p:a-koH (B113)

keNkeppakoo

they're going in single file

f.

han:a-?-koH (B48)

hanna?koo

their heads

(19)

Alternating vowel followed by one unsyllabifiable consonant
(either VHCCV(X) or VHC#): vowel surfaces as short.

a.
neH-m-?ok (B53)
nem?ok
this way

b.
haja:puH-j-ni-? (B104)
hajaapujni?
you will be a chief

c.
Tolko-meH-tki-? (B109)
Tolkometki?
a little one w/big ears

d.
ta:ciH-mhi-ko: (B110)
taacimhikoo
they are brothers

e.
cilen-:e-koH-N (B48)
cilennekoN
after they ate lunch

f.
cu?paH-m (B53)
cu?pam
in the middle

(20)

Alternating vowel followed by two unsyllabifiable consonants
(either VHCCCV(X) or VHCC#): vowel surfaces as long.

a.
?ono:?-ajaHk-h:Y-me-? (B98)
?onoo?ajaakyhhyme?
we were miners, long ago

b.
?oTki-liHp-tki-? (B108)
?oTkiliipytki?
little twin

c.
cam-h-haHk-j (B101)
camhyaakyj
dying (acc.)

d.
hikaHh-j (B50)
hikaahyj
deer (acc.)

(21)

Alternating vowel followed by three unsyllabifiable
consonants

(either VHCCCCV(X) or VHCCC#): vowel surfaces as short.

a.

hikaHh-m-?-hY: (B52)

hikahmy?hyy

from his deer

b.

?u:cuH-m:-nti-? (B52)

?uucummuntii

from my house

c.

neH-m:-?-?ok (B52)

nemmo??ok

from here

d.

wakaHl-m-t:i-? (B52)

wakalmytti?

from our creek

e.

?u:cuH-m:-? (B51)

?uucummu?

from the house

f.

wakaHl-m-? (B53)

wakalmy?

at the creek

(22)

Alternating vowel followed by four unsyllabifiable
consonants

(VHCCCCCV(X)): vowel surfaces as long.

kuteHw-Nk-tho-j (B82)

kuteewyNkythoj

as a messenger

These examples demonstrate that syllabification in SSM must be right-to-left. Notice that they also demonstrate that syllabification is not cyclic. SSM is a suffixing language; therefore subsequent cycles are always added to the right, giving the following type of structure:

(23)

[[[[hikaHh]m]?]hY:]

We have already determined that the syllabification of the root in the above word cannot be determined without reference to the following string. Notice that in the case of *hikahmy?hyy*, the syllabification of the root could not be determined until after the addition of the final

suffix, since the surface form of the alternating vowel depends on the total number of non pre-vocalic consonants which follow it, and this cannot be determined at any point prior to the addition of the final suffix. The information that is necessary to determining the surface length of alternating vowels is only available if syllabification takes place post-cyclically from right-to-left.

3.2 Syllabification and Epenthesis in SSM

I propose that SSM morphemes are partially syllabified lexically. Lexical syllabification constructs CV, CVV and CVC syllables from the rules of syllable projection, onset adjunction and coda adjunction. Extra material (i.e. stray consonants and floating x-slots, restricted to the peripheries) remain unsyllabified at the lexical level. Word-level syllabification builds maximal syllables from right-to-left on top of the already existing syllable structure. Word-level syllabification must respect previously built syllabic structure.

This is similar to the account of Arabic syllabification in Kenstowicz (1985).¹ Stress in Arabic is dependent on syllable structure - the rightmost heavy syllable is stressed, otherwise the first (up to the antepenult). Furthermore, stress assignment must occur before epenthesis to account for some apparent exceptions in the stress principle. Kenstowicz notes: "If we are to maintain this ordering of the rules along with the assumption that epenthesis is a phonological

response to extra-syllabic consonants then it follows that the phonological representation cannot be parsed exhaustively into syllables at a single point in the derivation" (p. 168).

His solution is to construct CV(C) syllables in the lexical phonology. Stress then applies to this partially syllabified string. Postlexical rules incorporate remaining consonants and insert epenthetic vowels in the appropriate environments.²

Lexical syllabification in SSM forms CV(X) syllables as follows: vowels project a syllable, incorporate a single consonant to the left as onset and, if the vowel is short, a single consonant to the right as coda. I assume that coda and onset adjunction at the lexical level can only incorporate x-slots that have phonemic content. Furthermore, no 'skipping' is allowed at this level - for instance, an x-slot with phonemic content cannot incorporate into coda position across a floating x-slot. The reasons for these assumptions will be discussed below. Note that a morpheme without a vowel will not build any structure lexically.

Let us consider some examples of lexical syllabification. Below, I show the forms *hikaHh-m-?-hY:* and *kuteHw-Nk-tho-j* before word-level syllabification takes place. Each morpheme has undergone lexical syllabification:

(24)

hikaHh-m-?-hY:

kuteHw-Nk-tho-j

o-	o-		c-	o-	o-		o-
/ \	/ \		/ \	/ \	/ \		/ \
x x x	x x x	- x -	x x x	x x x	x x x	- x x -	x x x - x
h i k	a h	m ?	h Y	k u t	e w	N k	t h o j
	*			*			

Note that in the roots, neither the floating x-slot nor the following consonant has been syllabified. The morphemes *-m-*, *-?-*, *-Nk-* and *-j-* have no vowels and thus are not syllabified at all lexically. The initial 't' of *-tho-* remains unsyllabified at this point. Note that all unsyllabified material is peripheral to the morpheme. Thus, though morphemes like *hikaHh-* and *-tho-* have unsyllabified elements at the periphery, SSM has no morphemes like **paatho* or **taHci*, which would contain morpheme-internal unsyllabified material after lexical syllabification has applied:

(25)

*	o-	o-		*	o-	o-
	/ \	/ \			/ \	/ \
	x x x	x x x			x x x	x x x
	p a	t h o			t a	c i

As another example, below I show the lexical syllabification of *jam:eH-HmetiH-tho-?-hY:*. (The word is shown at a point after the morphemes have been concatenated but before word-level syllabification occurs.)

(26)

o-	o-		o-	o-		o-	o-
/ \	/ \		/ \	/ \		/ \	/ \
x x x	x x x	- x -	x x x	x x x	- x x -	x -	x x x
j a	m e		m e t i	t o	?	h Y	

The morpheme *jam:eH-* ends in an alternating vowel and thus has a final floating x-slot. This floating x-slot is not syllabified lexically. The morpheme *-HmetiH-* both begins and ends in a floating x-slot (see Chapter 2 for discussion of morphemes beginning with floating x-slots). Both floating x-slots remain unsyllabified. The morpheme *-tHo-* begins with an alternating consonant. Recall that the representation of an alternating consonant is of a floating x-slot in combination with a floating phoneme. At the lexical level only the vowel in *-tHo-* is syllabified. The morpheme *-?-* has no vowel and thus remains unsyllabified. *-hY:-* is the only morpheme in the word which is fully syllabified lexically (i.e. contains no peripheral unsyllabified material).

At the word level, syllabification applies again. Elements that remained unsyllabified at the lexical level will become incorporated (or undergo Deletion) during word level syllabification. As demonstrated earlier, in Section 3.1, syllabification must be right-to-left in order to account for the patterns of epenthesis and vowel length alternations.

Word-level syllabification must respect previously built syllable structure. This is meant in a very particular way - previously built syllables may be added to, by coda or onset adjunction, but previously built structure may not be erased.³ Syllabification scans the x-slot tier from right-to-left, and upon encountering unsyllabified x-slots will incorporate them into syllabic structure, in the manner to be described herein.

Word-level syllabification is subject to Maximality (Ito, 1986, 1989). Maximality ensures that epenthesis will form a single heavy syllable rather than two light syllables when confronted with adjacent unsyllabified consonants (in languages allowing CVC syllables). As Ito describes it: "each epenthetic vowel rescues as many consonants as possible" (Ito, 1989, p. 243). This predicts that in a sequence of four consonants (where the first is syllabified as coda and the last as onset to adjacent vowels) epenthesis will occur between the second and third consonants as in 27b.

- (27)
- a. o- o-
 | \ / |
 V C C' C' C V
- b. o- o- o-
 | \ / | \ / |
 V C C y C C V
 ^
- c. * o- o- o- o-
 | \ / | / | / |
 V C C y C y C V
 ^ ^

My use of Maximality differs in many respects from Ito's usage. These differences result primarily from the fact that syllable structure in SSM is built at two different levels, the lexical level and the word-level.⁴ During word-level syllabification an unsyllabified x-slot must adjoin to a previously built syllable if at all possible (thus maximizing this syllable). In accordance with the fact that onsets have priority in syllabification (all syllables must have onsets) an unsyllabified x-slot will adjoin as onset to a previously built syllable

if possible; otherwise, as coda. As an example, let us consider the syllabification of *komta_ha* (*komta-h-a*) 'he hit himself!', below. (Words that end in short vowels undergo final lengthening; all SSM words must end in a heavy syllable, thus, the surface *komta_haa*.)

(28)

a. Lexical Syllabification:

```

      o-    o-  o-
     /|\   /|  |
    x x x x x-x-x
    | | | | | | |
    k o m t a h a

```

b. Word-level syllabification:

```

      o-    o-  o-
     /|\   /|  /|
    x x x x x-x-x
    | | | | | | |
    k o m t a h a

```

The 'h' remains unsyllabified at the lexical level. During word-level syllabification this unsyllabified consonant must be incorporated into syllabic structure. In this case, the 'h' would 'fit' into either the preceding or following syllable. The preceding syllable is light and so it is possible that the 'h' could be adjoined as coda and thus maximize the syllable. Given that the following syllable is onsetless, however, the 'h' must incorporate as onset, as in 28b.

Another case of incorporating into previously built structure is found in the word (*halpa-ka-nti-j*), below:

(29)

a. Lexical syllabification:

```
      o-      o-  o-      o-
     /|\    /|  /|      /|
    x x x x x-x x-x x x-x
    | | | | | | | | | |
    h a l p a k a n t i j
```

b. Word-level syllabification:

```
      o-      o-  o-      o-
     /|\    /|  /|\    /|\
    x x x x x-x x-x x x-x
    | | | | | | | | | |
    h a l p a k a n t i j
```

The right-to-left scan first encounters the unsyllabified 'j'. It is incorporated as coda of the preceding syllable, thus maximizing this syllable. The scan continues and encounters the unsyllabified 'n' of *nti-* which is incorporated into the preceding syllable.⁵

If, during word-level syllabification, unsyllabified consonants are unable to incorporate into adjacent syllables as in the above examples, then epenthesis occurs. Epenthesis is subject to Maximality. This means that epenthesis will always apply in such a way as to form a heavy syllable, if possible; otherwise it will form a light, open syllable. This use of Maximality is the one proposed by Ito (see also Selkirk 1981). It entails that if there are two adjacent unsyllabified consonants, epenthesis will occur between them and a heavy syllable will be formed as in 30a. If there is only one unsyllabified consonant, then, as a result of the SSM requirement that syllables must have onsets, epenthesis will apply to its right, and the consonant will become an onset to the epenthetic vowel as in 30b.

(30)

a. C' C' -> $\begin{array}{c} \text{o-} \\ / \quad \backslash \\ \text{C} \quad \text{y} \quad \text{C} \end{array}$

b. C' -> $\begin{array}{c} \text{o-} \\ / \quad | \\ \text{C} \quad \text{y} \end{array}$

To see how this works, let us examine the derivation of *jawwejynti?* (*jaw:e-j-nti-?*) below.

(31)

a. Lexical syllabification:

$$\begin{array}{cccc} & \text{o-} & & \text{o-} & & & & \text{o-} & & & \\ & / \quad \backslash & & / \quad | & & & & / \quad | & & & \\ \text{x} & \text{x} & \text{x} & \text{x} & \text{x} & \text{x} & \text{x} & \text{x} & \text{x} & \text{x} & \\ | & | & \backslash & / & | & | & | & | & | & | & \\ \text{j} & \text{a} & \text{w} & \text{e} & \text{j} & \text{n} & \text{t} & \text{i} & ? & & \end{array}$$

b. Word-level syllabification:

$$\begin{array}{cccc} & \text{o-} & & \text{o-} & & \text{o-} & & \text{o-} & & & \\ & / \quad \backslash & & / \quad | & & / \quad \backslash & & / \quad \backslash & & & \\ \text{x} & \text{x} & \text{x} & \text{x} & \text{x} & \text{x} & \text{x} & \text{x} & \text{x} & \text{x} & \\ | & | & \backslash & / & | & | & | & | & | & | & \\ \text{j} & \text{a} & \text{w} & \text{e} & \text{j} & \text{y} & \text{n} & \text{t} & \text{i} & ? & \\ & & & & \sim & & & & & & \end{array}$$

Word-level syllabification scans the x-tier, encountering the unsyllabified glottal stop, and incorporates it into the preceding syllable. The scan continues and encounters two adjacent unsyllabified consonants, the 'n' and 'j'. In accordance with Maximality, epenthesis occurs between these two consonants and the heavy syllable 'jyn' is formed.

As a case of epenthesis forming an open syllable, let us examine the derivation of *hywaatynaa* (*hywa:-t-ma:*) below.

(32)

a. Lexical syllabification:

```
      o-  o-      o-
     /|  /|\    /|\
    x x x x x-x-x x x
    | | | | /  | | | /
    h y w a   t m a
```

b. Word-level syllabification:

```
      o-  o-      o-  o-
     /|  /|\    /|  /|\
    x x x x x x x x x x
    | | | | /  | | | | /
    h y w a   t y m a
                    ^
```

Only a single unsyllabified consonant remains after lexical syllabification. In accordance with the fact that syllables must have onsets, epenthesis applies to the right of this consonant and forms the light syllable 'ty'.

One of the facts about epenthesis in SSM is that it is restricted to morpheme boundaries. (This is quite problematic to an account of syllabification which does not incorporate two distinct stages of syllable-building as proposed herein; see Section 3.3.) This distributional fact follows from the account of syllabification which I argue for herein (given the possible morpheme shapes in SSM and their distribution). To see this, let's examine the behavior of the morpheme *wyks-*. Below is the derivation of *wyksyka?hyy* (*wyks-ka-?-hY:*):

(33)

a. Lexical syllabification:

o-	o-	o-
/ \	/ \	/ \
x x x x	- x x	- x - x x x
		/
w y k s	k a	? h Y

b. Word-level syllabification:

o-	o-	o-	o-
/ \	/ \	/ \	/ \
x x x x	x x x x	x x x x	x x x
			/
w y k s	y k a	? h Y	

In morphemes of this type (i.e. those ending in a consonant cluster) lexical CVC syllabification will always result in there being a single unsyllabified C morpheme-finally. Recall that SSM morphemes can have at most two consonants in initial or final position. CV(X) syllabification will thus either totally syllabify a morpheme (assuming it has a vowel) or leave at most one consonant unsyllabified at the morpheme boundary. If a morpheme ending in a cluster (*wyks-* for example) is followed by a CV sequence, there will be only a single unsyllabified consonant (the 's') when word-level syllabification applies and epenthesis will occur to its right, resulting in an open syllable, as in 33. If *wyks* is followed by another unsyllabified consonant, as in the case below, maximality will cause a heavy syllable to be formed with epenthesis applying between the two unsyllabified consonants, as in 34. In both cases epenthesis will occur only at the morpheme boundary.⁶

(34)
 wyks-j-ni-? (B48)
 wykcyjni?
 you will go

(35)
 a. Lexical syllabification:

o-		o-
/ \		/ \
x x x x	- x -	x x - x
w y k s	j	n i ?

b. Word-level syllabification:

o-	o-	o-
/ \	/ \	/ \
x x x x	x x x x	x x x
w y k s	y j	n i ?

I stated above that during lexical syllabification floating x-slots are not incorporated, nor can they be skipped over. The reason for this is the observation made previously that the surface length of alternating vowels can only be determined by the right-to-left word-level syllabification. If x-slots were lexically incorporated as codas, this would predict that all alternating vowels surface as long, as below:

(36)

a. Lexical Syllabification (inc. floating x-slots):

o-	o-		o-		o-	o-		o-																										
/	/ \		/ \		/	/ \		/																										
x	x	x	x	x	x	-	x	-	x	-	x	x	x	x	x	x	x	x	x	-	x	x	-	x	x	x	-	x						
										/																								
h	i	k	a	h	m	?	h	Y	k	u	t	e	w	N	k	t	h	o	j															
			*									*																						

b. Word-level syllabification, Spreading:

o-	o-	o-	o-	o-		o-	o-	o-	o-	o-																						
/	/ \	/	/ \	/ \		/	/ \	/ \	/ \	/ \																						
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
				/							/				/																	
h	i	k	a	h	y	m	y	?	h	Y	k	u	t	e	w	y	N	k	y	t	h	o	j									
			*		^		^							*		^		^														

*[hikaahymy?hyy]

[kuteewyNkythoj]

As we can see, incorporating floating x-slots during lexical syllabification derives **hikaahymy?hyy* instead of the correct surface form, *hikahmy?hyy*. (This procedure will result in incorrect derivations for all words which contain an alternating vowel followed by an odd number of non-prevocalic consonants.)

Alternatively, if x-slots could be skipped over, this would have the effect that all alternating vowels followed within the same morpheme by a consonant would surface as short:

(38)

a. Lexical syllabification:

```

      o-  o-                o-
      /|  /|                /|\
x x x x x x - x - x - x x x
| | | | | | | | | |
h i k a   h   m   ?   h Y
          *

```

b. Word-level syllabification - Step 1:

```

      o-  o-                o-  o-
      /|  /|                /|\  /|\
x x x x x x - x x x x x x
| | | | | | | | | | | |
h i k a   h   m y ? h Y
          *   ^

```

c. Word-level syllabification -Step 2:

```

      o-  o-                o-  o-
      /|  /|  \  /|\  /|\
x x x x x x x x x x x x
| | | | | | | | | | | |
h i k a   h m y ? h Y
          *   ^

```

e. Deletion:

```

      o-  o-                o-  o-
      /|  /|\  /|\  /|\
x x x x x x x x x x x x
| | | | | | | | | | | |
h i k a h m y ? h Y
          *   ^

```

I have divided the word-level syllabification into steps to make the derivation easier to follow. The word-level right-to-left scan will first encounter the adjacent unsyllabified consonants '?' and 'm' and will epenthesize between them, forming the heavy syllable 'my?'. The scan continues and encounters the unsyllabified root-final 'h'. There is no adjacent consonant, so epenthesis would normally occur to the right of this consonant. Recall, however, that an unsyllabified

consonant must first incorporate into an adjacent syllable if possible (thereby maximizing said syllable); only if such incorporation is impossible will epenthesis apply. The consonant in question, 'h', is preceded in this case by a light syllable 'ka' and thus is able to adjoin as a coda. Note that in doing so it 'skips' over a floating x-slot. We have already claimed that this was not possible at the lexical level. Clearly, in order to derive the appropriate surface form, we need to allow this to happen at the word-level (this will be discussed more fully below).

I assume that the right-to-left scan continues and encounters the floating x-slot. Notice, however, that this slot cannot be incorporated into the syllable, nor can it project its own syllable (inducing epenthesis) as this would involve crossing of association lines. The last step of the derivation is Deletion, which deletes this unsyllabifiable floating x-slot.

Let us compare this to the derivation of *kuteewyNkythoj*, given below.

(39)

a. Lexical syllabification:

```
      o-  o-                o-
      /|  /|                /|
x x x x x x - x x - x x x - x
| | | |   |   | |   | | | |
k u t e   w   N k   t h o   j
      *
```

b. Word-level syllabification - Step 1:

```
      o-  o-      o-      o-      o-
      /|  /|      /|\     /|\     /|\
x x x x x x x x x x x x x x x
| | | |   | | | | | | | | | |
k u t e   w y N k y t h o j
      *       ^       ^
```

c. Word-level syllabification - Step 2:

```
      o-  o-      o-      o-      o-
      /|  /|\     /|\     /|\     /|\
x x x x x x x x x x x x x x x
| | | | / | | | | | | | | | |
k u t e   w y N k y t h o j
      *       ^       ^
```

d. Spreading:

```
      o-  o-      o-      o-      o-
      /|  /|\     /|\     /|\     /|\
x x x x x x x x x x x x x x x
| | | | / | | | | | | | | | |
k u t e   w y N k y t h o j
      *       ^       ^
```

Word-level syllabification proceeds as follows. The final 'j' in adjoined as coda into the preceding syllable. The scan next encounters two adjacent unsyllabified consonants and epenthesizes between them, forming the heavy syllable 'kyt'. The scan continues and again encounters two unsyllabified consonants and epenthesizes to form the heavy syllable 'wyN'. These steps are shown in 39b. The scan next encounters the floating x-slot. It is incorporated into the preceding

syllable, shown in 39c. The last step of the derivation is Spreading, which spreads the vowel 'e' onto the adjacent empty x-slot.

Notice that word-level syllabification can incorporate floating x-slots into syllabic structure, unlike lexical syllabification. We saw above that it can also 'skip' over a floating x-slot. The latter process is due to the assumption made in Chapter 2 that x-slots with phonemic content have precedence over floating x-slots.

Interesting evidence for the representation of alternating vowels which I adopt herein comes from the fact that short vowels, when followed by a floating-x suffix, exhibit the same alternations as an alternating vowel. Thus, the underlying sequence in 40a behaves in the same manner as the alternating vowel in 40b. The distinction between the two is the presence of the morpheme boundary in 40b.

(40)

a.	x-x	b.	x x
	v		v

If an alternating vowel were not represented as in 40b (i.e. with a floating x-slot) there would be no explanation for this fact. Let us examine the relevant data.

In Chapter 2, we looked at floating-x suffixes - suffixes which caused lengthening of the final phoneme of the preceding morpheme. I proposed that these suffixes had an initial floating x-slot. An example follows.

(41)
lit-h-a-:me? (B63)
lithaame?
it's risen on us

The representation of *-:me?* is in 42 and the derivation of *lithaame?* in 43.

(42)

```

x x x x
 | | |
 m e ?

```

(43)

a. Underlying representation:

```

x x x-x-x-x x x x
 | | | | | | | |
 l i t h a m e ?

```

b. Lexical syllabification:

```

  o-    o-    o-
 /|\   /|\   /|\
x x x-x-x-x x x x
 | | | | | | | |
 l i t h a m e ?

```

c. Word-level syllabification:

```

  o-    o-    o-
 /|\   /|\   /|\
x x x-x-x-x x x x
 | | | | | | | |
 l i t h a m e ?

```

d. Spreading:

```

  o-    o-    o-
 /|\   /|\   /|\
x x x-x-x-x x x x
 | | | | | / | | |
 l i t h a m e ?

```

Now let us examine the suffix *-Hs-*. The suffix has the following representation:

(44)
 x x
 |
 s

This suffix, as expected, will lengthen a preceding short vowel. This can be seen in the following example:

(45)
 jaw:e-Hs-?-hY: (B54)
 jawweesy?hyy
 with his bow

The suffix *-Hs-* does not always lengthen a preceding short vowel, however, as illustrated below:

(46)
 jaw:e-Hs (B54)
 jawwes
 with a bow

monac:a-t:i-Hs-le: (B183)
 monaccattislee
 [??]

?i-Hs-?ok (B131)
 ?is?ok
 [??]

Notice that the short vowel preceding this suffix mirrors the behavior of an alternating vowel. In the above examples, the vowel in question is in each case followed by a floating x-slot and one unsyllabifiable (non-prevocalic) consonant. When an alternating vowel is followed by one non-prevocalic consonant it surfaces as short. Let us compare the word *?is?ok* (*?i-Hs-?ok*), in which the floating x-slot is morpheme-initial and follows an underlying short vowel, with *neH-m-?ok*, in which the floating x-slot is part of the representation of the underlying alternating vowel of the root.

(47)

a. Lexical Syllabification:



b. Word-level syllabification:



c. Deletion:

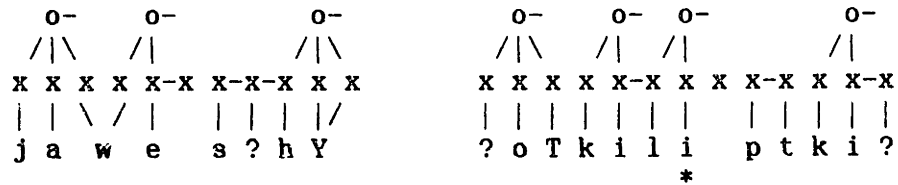


In both of these cases, the floating x-slot cannot be syllabified and is deleted. Both vowels surface as short.

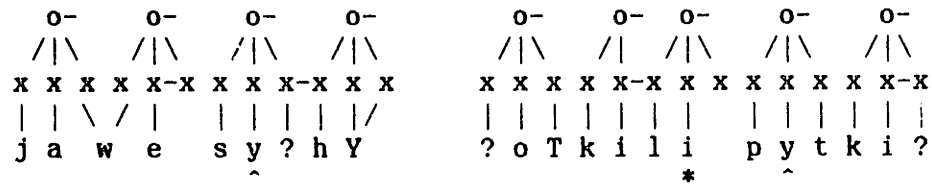
In the word *jawweesy?hyy* (*jaw:e-Hs-?-hY:*) the short vowel of the root is followed by the suffix-initial floating x-slot, followed by a sequence of two non-prevocalic consonants. We saw in 3.1.2 that an alternating vowel surfaces as long when followed by an even number of non-prevocalic consonants. Let us compare *jawweesy?hyy* with *?oTkiliipytki* (*?oTki-liHp-tki-?*), in which the alternating vowel is followed by two non-prevocalic consonants.

(48)

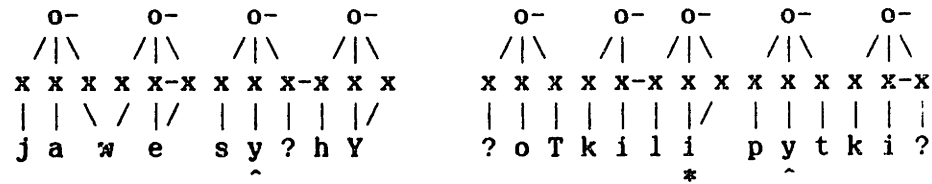
a. Lexical syllabification:



b. Word-level syllabification:



c. Spreading:



Again, the behavior of a short vowel followed by a floating x-slot is identical to that of an underlying alternating vowel. This is to be predicted if the alternating vowel is represented as a short vowel followed by a floating x-slot.

If we were to adopt an alternative representation of alternating vowels (for example, one which distinguishes such vowels by the presence of a feature), the identical behavior of short vowels followed by floating-x suffixes to alternating vowels would be inexplicable.

I have established herein that a right-to-left syllabification procedure applies and that it scans the x-slot tier, incorporating floating x-

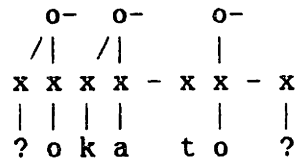
slots and unsyllabified consonants into previously built syllables, and, where necessary, epenthesis. In the previous Chapter, I argued that SSM utilizes both floating x-slots and floating phonemes. What part do floating phonemes have in the syllabification process?

I propose that after word-level syllabification has scanned the x-slot tier, a right-to-left scan of the phoneme tier is made, targeting floating phonemes. Any floating phonemes that are encountered are adjoined as coda into the preceding syllable if possible, (generating an x-slot in the process). If a floating phoneme cannot be so incorporated it will be deleted at the final step in the derivation, Deletion, which deletes all unassociated (i.e. unlicensed) x-slots and phonemes.

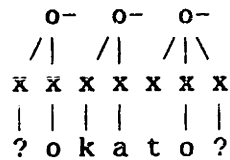
As an example, let us consider the syllabification of the word *?okatto?* (*?oka-tHo-?*) 'to the same place'.

(49)

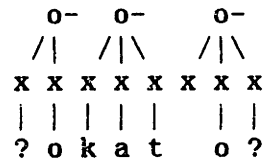
a. Lexical syllabification



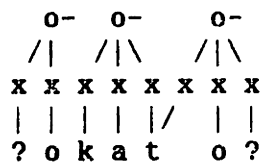
b. Word-level syllabification (x-slot scan):



c. Word-level syllabification (phoneme scan):



d. Spreading



Word-level syllabification first scans the x-slot tier, incorporating the final glottal stop as a coda, and the floating x-slot of *-tHo-* as an onset to the final syllable. Next, the phoneme tier is scanned, encountering the floating phoneme 't' (associated with the morpheme *-tHo-*). Since the 't' is preceded by a light syllable, there is room to incorporate it into such syllable as coda. In doing so, it projects an

x-slot as in 49c. Spreading then applies, which spreads the 't' onto the following empty onset position.

One of the facts about alternating phonemes pointed out in Chapter 2 is that the sequence alternating vowel - alternating consonant (VH-CH) always results in a long vowel followed by a short consonant (V:C). To see how the model I propose herein derives this result, let us examine the derivation of the word in 50.

(50)
jam:eH-HmetiH-tHo-?-hY: (B122)
jammeemetiito?huu
to the graves

This word is interesting not only for the sequence of an alternating vowel followed by an alternating consonant, but also for the sequence of an alternating vowel followed by a floating-x suffix. The lexical syllabification of this form was discussed previously in this Section. The derivation of the word is given in 51.

(51)

a. Lexical syllabification:

```

      o-   o-       o-  o-   o-   o-
      /|\  /|      /|  /|    |   /|\
x x x x x x-x x x x x x-x x-x-x x x
| | \ / |      | | | |    | | | | /
j a m e       m e t i   t o ? h Y
      *               *

```

b. Word-level syllabification:

```

      o-   o-       o-  o-   o-   o-
      /|\  /|      /|  /|\  /|\  /|\
x x x x x x-x x x x x x-x x-x-x x x
| | \ / |      | | | |    | | | | /
j a m e       m e t i   t o ? h Y
      *               *

```

c. Word-level syllabification (cont.):

```

      o-   o-       o-  o-   o-   o-
      /|\  /| \   /|  /|\  /|\  /|\
x x x x x x-x x x x x x-x x-x-x x x
| | \ / | /   | | | | /   | | | | /
j a m e       m e t i   t o ? h Y
      *               *

```

d. Spreading:

```

      o-   o-       o-  o-   o-   o-
      /|\  /| \   /|  /|\  /|\  /|\
x x x x x x-x x x x x x-x x-x-x x x
| | \ / | /   | | | | /   | | | | /
j a m e       m e t i   t o ? h Y
      *               *

```

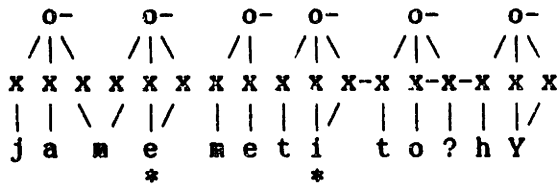
e. Association:

```

      o-   o-       o-  o-   o-   o-
      /|\  /| \   /|  /|\  /|\  /|\
x x x x x x-x x x x x x-x x-x-x x x
| | \ / | /   | | | | /   | | | | /
j a m e       m e t i   t o ? h Y
      *               *

```

f. Deletion:



Word-level syllabification proceeds as follows. The unsyllabified '?' is incorporated as coda into the preceding syllable. The scan next encounters the floating x-slot associated with the morpheme *-tHo-*. This slot is incorporated into the onset of the following syllable. These two steps form a heavy syllable with an empty x-slot as onset and 'o?' as rhyme.

The right-to-left scan continues and encounters the floating x-slot associated with the final alternating vowel of *-HmetiH-*. This slot is incorporated into the preceding syllable. These steps are shown in 51b.

As the scan continues, it targets the initial floating x-slot of *-HmetiH-*. This slot is incorporated into the preceding syllable (in doing so, skipping over the floating x-slot associated with *jam:eH-*). We have assumed that x-slots with phonemic content 'win' over empty x-slots in syllabification. In a case such as this where there are two adjacent floating x-slots, directionality predicts that the rightmost one will incorporate, thus skipping over the leftmost one. This step is shown in 51c.

Spreading then applies, spreading both the 'e' of *jam:eH-* and the 'i' of *-HmetiH-* rightward. Association will associate the floating 't' of *-*

tHo- into the empty onset position. Finally Deletion will apply, deleting any unsyllabified elements from the string.

3.3 Prosodic Syllabification

In this Section, I will outline the approach to syllabification advocated by Ito (1986, 1989) (henceforth "prosodic syllabification") and show that it fails to account for the SSM data.

Ito assumes that syllabification is subject to the Principles and Parameters of Prosodic Theory (see Prince 1985).⁷ In particular, syllabification is subject to Maximality, Directionality and the Onset Principle. Maximality was discussed in the previous Section.

Right-to-left syllabification, as described by Ito, entails that an epenthetic vowel is placed to the left of an unsyllabified consonant; that is, epenthesis corresponds to the skeletal epenthesis rule in 52a rather than the one in 52b.

- (52)
a. $0 \rightarrow V / _ C'$
b. $0 \rightarrow V / C' _$

This can be seen quite clearly by comparing syllabification in Cairene and Iraqi Arabic. In a cluster of four consonants, both Cairene and Iraqi insert an epenthetic vowel as follows: $0 \rightarrow i / CC_CC$. In tri-consonantal clusters, however, the two languages pattern differently, as shown below for the words meaning 'I said to him'. (For discussion of these facts, see Broselow 1980, 1982, Selkirk 1981 and Ito 1986, 1989.)

(53)

a. Cairene: 0 -> i/ CC_C

/ʔul-t-l-u/ -> ʔultilu

b. Iraqui: 0 -> i/ C_CC

/gil-t-l-a/ -> gililita

It shows that we can account for this distinction if we assume that Cairene employs left-to-right syllabification and Iraqui right-to-left, as below.

(54)

a. Cairene

$\begin{array}{c} \text{o-} \\ / \backslash \\ \text{ʔ u l-t-l-u} \end{array}$	->	$\begin{array}{c} \text{o-} \quad \text{o-} \\ / \backslash \quad / \\ \text{ʔ u l t i l u} \\ \quad \quad \quad \hat{\quad} \end{array}$	->	$\begin{array}{c} \text{o-} \quad \text{o-} \quad \text{o-} \\ / \backslash \quad / \quad / \\ \text{ʔ u l t i l u} \\ \quad \quad \quad \hat{\quad} \end{array}$
--	----	--	----	---

b. Iraqui

$\begin{array}{c} \text{o-} \\ / \\ \text{g i l-t-l-a} \end{array}$	->	$\begin{array}{c} \text{o-} \quad \text{o-} \\ / \backslash \quad / \\ \text{g i l i t l a} \\ \quad \quad \quad \hat{\quad} \end{array}$	->	$\begin{array}{c} \text{o-} \quad \text{o-} \quad \text{o-} \\ / \quad / \backslash \quad / \\ \text{g i l i t l a} \\ \quad \quad \quad \hat{\quad} \end{array}$
--	----	--	----	---

(Note that the second step in 54a does not form a maximal syllable *til* because of the Onset Principle, discussed more fully below.)

We can see the effect of directionality in SSM by looking at the word *jawwejynti?*, shown below.

(55)

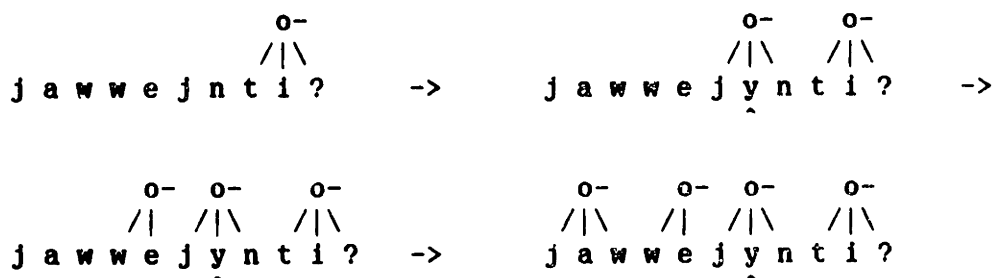
jaw:e-j-nti-? (B104)

jawwejynti?

it will be my bow

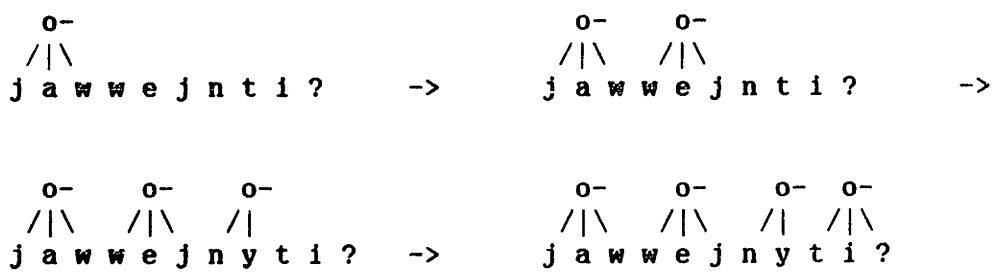
(56)

Right-to-left syllabification:



(57)

*Left-to-right syllabification:



As demonstrated above, right-to-left syllabification normally causes epenthesis to the left of an unsyllabified consonant; this, however, is modulo the Onset Principle. In SSM, the Onset Principle is absolute - all syllables must have onsets. The effect on epenthesis is shown below, for the word *hywaatymaa*.

(58)

hywa:-t-ma: (B36)

hywaatymaa

I am running

If epenthesis were to occur to the left of the 't', as below, it would result in a violation of the Onset Principle (since there is no available consonant to the left of the 't' to be incorporated as onset).

syllables; only if it is impossible to form a heavy syllable can epenthesis result in an open syllable.

Now that we have seen how Directionality, Maximality and the Onset Principle operate, let us see how prosodic syllabification might account for the alternating vowels of SSM. Recall the fact that an alternating vowel will surface as long or short depending on the number of following consonants, as is demonstrated by the pair below.

(62)		
hikaHh-m-?-hY:	(B52)	kuteHw-Nk-tho-j (B82)
hikahmy?hyy		kuteewyNkythoj
from his deer		as a messenger

The prosodic syllabification of *kuteewyNkythoj* is as follows.⁸

(63)

a. Underlying Representation

```

x x x x x x   x x   x x x x
| | | |   | |   | | | |
k u t e   w - N k - t h o-j
      *

```

b. Syllabification - Step 1:

```

              o-
             /|\
x x x x x x   x x   x x x x
| | | |   | |   | | | |
k u t e   w - N k - t h o-j
      *

```

c. Step 2:

```

              o-   o-
             /|\  /|\
x x x x x x   x x x x x x x
| | | |   | | | | | | | |
k u t e   w - N k y t h o-j
      *           ^

```

d. Step 3:

```

              o-   o-   o-
             /|\  /|\  /|\
x x x x x x x x x x x x x x
| | | |   | | | | | | | |
k u t e   w y N k y t h o-j
      *           ^   ^

```

e. Steps 4 and 5:

```

              o-   o-   o-   o-   o-
             /|\  /|\  /|\  /|\  /|\
x x x x x x x x x x x x x x
| | | | / | | | | | | | |
k u t e   w y N k y t h o-j
      *           ^   ^

```

f. Spreading

```

              o-   o-   o-   o-   o-
             /|\  /|\  /|\  /|\  /|\
x x x x x x x x x x x x x x
| | | | / | | | | | | | |
k u t e   w y N k y t h o-j
      *           ^   ^

```

In Step 2 of syllabification, in accordance with Maximality, a heavy syllable, *kyt*, is formed. Step 3 forms the heavy syllable *wyN*. Step 4 incorporates the floating x-slot into the syllable, and in 63f Spreading applies to form the long vowel.

Let us compare this to the syllabification of *hikahmy?hyy*, in which the alternating vowel surfaces as short. The initial steps of the derivation are shown below.

- (64)
 a. Underlying Representation

```

x x x x x x-x - x-x x x
| | | | | | | | | /
h i k a h m ? h Y
      *
```

- b. Syllabification - Step 1:

```

              o-
              /|\
x x x x x x-x - x-x x x
| | | | | | | | | /
h i k a h m ? h Y
      *
```

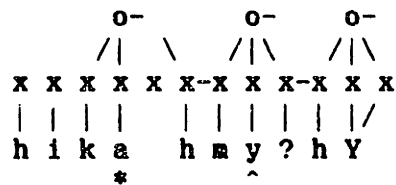
- c. Step 2:

```

              o-      o-
              /|\    /|\
x x x x x x-x x x-x x x
| | | | | | | | | /
h i k a h m y ? h Y
      *      ^
```

In the surface form of this word, the alternating vowel is short and its syllable is closed by the root-final consonant, 'h'. Thus, we want the next step of the derivation to be as follows:

(65)
 d. Step 4:



If we make the assumption, which I advocate herein, that x-slots with phonemic content have precedence over floating x-slots and can 'skip over' the latter in syllabification, a prosodic approach will account for these forms.

Thus, by making the additional assumptions that (i) phonological models contain an x-tier, (ii) syllabification scans the x-tier, and (iii) that x-slots with phonemic content have precedence over floating x-slots, prosodic syllabification will account for the surface variation of alternating vowels in SSM. In addition, we saw above that prosodic syllabification correctly derives the words *jawwejynti?* and *hywaatymaa*.

Although prosodic syllabification correctly syllabifies these cases, there is a set of words in SSM for which it fails to correctly derive the surface syllabification. Consider the word *mulhuhak*, given below.

(66)
 mul-h-haHk (B101)
 mulhuhak
 quitting

Recall Ito's analysis of Cairene and Iraqui Arabic. In Cairene epenthesis will occur between C₂ and C₃ of a triconsonantal cluster; in

Iraqi epenthesis occurs between C₁ and C₂. The relevant data is repeated below.

(67)

a. Cairene: 0 -> i/ CC_C

/ʔul-t-l-u/ -> ʔultilu

b. Iraqi: 0 -> i/ C_CC

/gil-t-l-a/ -> gilitla

The explanation provided by Ito is that syllabification in Cairene is left-to-right and in Iraqi it is right-to-left. Right-to-left syllabification should always produce an epenthesis pattern similar to Iraqi. We have determined that syllabification in SSM is right-to-left, and therefore epenthesis in triconsonantal clusters should occur between C₁ and C₂. This is in fact the case in *jawwejyntiʔ*, where the sequence *jnt* becomes *jynt*. In *mulhuhak*, however, we find the opposite pattern, with epenthesis occurring in the Cairene, or left-to-right, pattern. This presents a serious problem for prosodic syllabification. Let us look more closely at the two words in question.

Applying prosodic syllabification to *mul-h-hakk* incorrectly derives **muluhhak*, as shown below.

(68)

a. Underlying representation

```

x x x - x -x x x x
| | | | | | |
m u l h h a k
      *
```

b. Syllabification - Step 1:

```

      o-
     /|\
x x x - x -x x x x
| | | | | | |
m u l h h a k
      *
```

c. Step 2:

```

      o-      o-
     /|\     /|\
x x x x x -x x x x
| | | | | | |
m u l u h h a k
      ^      *
```

d. Step 3:

```

      o-  o-      o-
     /|\ /|\     /|\
x x x x x -x x x x
| | | | | | |
m u l u h h a k
      ^      *
```

e. Stray Erasure:

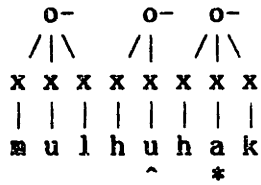
```

      o-  o-      o-
     /|\ /|\     /|\
x x x x x -x x x
| | | | | | |
m u l u h h a k
      ^      *
```

*muluhhak

The actual syllabification of *muluhak* is shown below.

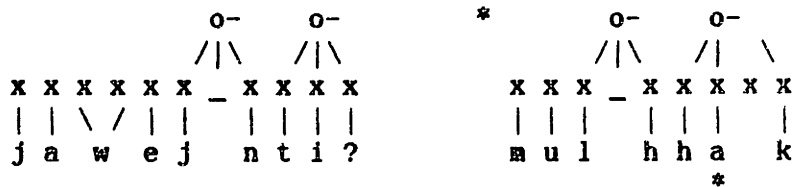
(69)



The epenthetic vowel occurs to the right of the 'h'. Recall that if there are adjacent unsyllabified consonants an epenthetic vowel will occur between them, but if there is only one unsyllabified consonant, the epenthetic vowel will follow it. In other words, epenthesis will always apply in such a way as to form a heavy syllable if possible; only if it can not do so will it form an open syllable. In the second step of the syllabification of *mulhuhak* (i.e. construction of the second syllable) epenthesis must form an open syllable even though the environment for forming a heavy syllable - two adjacent consonants - is met. Epenthesis applies as if the 'l' of *mul-* is not visible to the scan.

We can compare the crucial steps in the derivations of *jawwejynti?* and *mulhuhak*, as below.

(70)

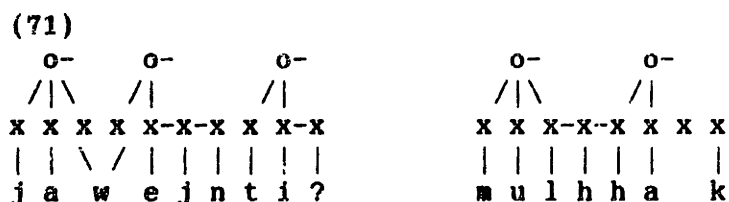


In *jawwejynti?* the 'j' and 'n' behave like a sequence of consonants and become the onset and coda of the epenthetic vowel, respectively. In *mulhuhak*, it appears as if the 'l' is unavailable; as if, in fact, it

were already in some way associated with the coda position of the word-initial syllable (impossible given right-to-left prosodic syllabification).

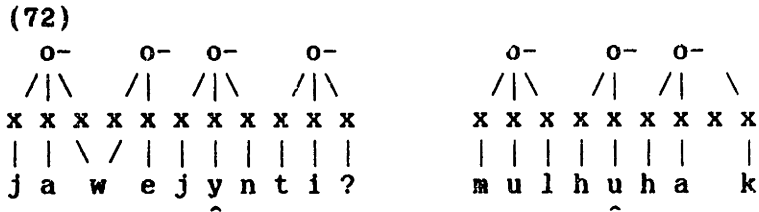
Notice that the difference between the two cases is in the presence of morpheme boundaries - there is a morpheme boundary before the 'j' of *jawwejynti?* (*jaw:e-j-nti-?*) but no morpheme boundary before the 'l' of *mulhuhak* (*mul-h-haHk*). Given that syllabification in SSM must be a right-to-left non-cyclic process, the presence or absence of a morpheme boundary should have no effect on the prosodic syllabification. It is a fairly standard assumption within most phonological frameworks that morpheme boundaries are erased with the addition of each new cycle, so that at the point where prosodic syllabification would occur in SSM these boundaries should not be visible (see Kiparsky 1982).

Note that the distinction between the two words in question is captured under the approach to syllabification which I argue for herein. The lexical syllabifications of the two words follows:



The 'j' of *jawwejynti?* is unsyllabified lexically and there is thus a sequence of unsyllabified consonants which will form a heavy syllable during word-level syllabification. The 'l' in *mulhuhak*, however, is syllabified lexically. This leaves a single unsyllabified consonant

('h') and word-level syllabification will epenthesize to its right, deriving a light syllable. This is demonstrated below.



The distinctions in the syllabifications of *jawwejynti?* and *mulhuhak* are of the type that can often be explained by the cyclic application of syllable-building processes. Thus, we have a pseudo-cyclic effect occurring in a non-cyclic operation.

Related to this problem is another fact about SSM epenthesis which is inexplicable given prosodic syllabification; namely, that epenthesis in SSM never occurs within morphemes, but only at morpheme boundaries. The problem this entails is the one just pointed out - the morpheme boundaries are predicted by the theory not to be visible when syllabification applies.

Notice that, although the morpheme boundary problem is related to the pseudo-cyclic effects described above, they are actually two distinct phenomena. In *mulhuhak* there is a morpheme boundary on both sides of the 'h'; thus, the fact that epenthesis does not occur to the left of the 'h' as the syllabification procedure predicts is unrelated to the fact that epenthesis is restricted to occur at morpheme boundaries.

This restriction on morpheme-internal epenthesis can be seen in the following SSM words.

(73)
 wyks-ka-?-hY: (B105)
 wykasyka?hyy
 the way he went

welh-my-ksY- (B??)
 welhymyksy-
 [??]

?enh-ji-keH-? (B69)
 ?enhyjike?
 he went to fix it

In each of these cases, prosodic syllabification predicts epenthesis between the second and third root consonants. As an example, when prosodic syllabification is applied to *wyks-ka-?-hY:*, the incorrect form **wykyska?hyy* is derived, as shown below:

(74)
 a. Syllabification - Steps 1 and 2:

```

          0-      0-
         /|\    /|\
    x x x x - x x-x-x x x
    | | | | | | | | | /
    w y k s   k a ? h Y
  
```

b. Step 3:

```

          0-      0-      0-
         /|\    /|\    /|\
    x x x x x-x x-x-x x x
    | | | | | | | | | /
    w y k y s k a ? h Y
          ^
  
```

c. Step 4:

```

*          0-      0-      0-      0-
         /|\    /|\    /|\    /|\
    x x x x x-x x-x-x x x
    | | | | | | | | | /
    w y k y s k a ? h Y
          ^
  
```

The correct syllabification of this word is shown below:

(75)



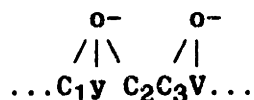
The epenthetic vowel is inserted at the boundary between the root and the following suffix. This is similar to the case described above for *mulhuhak*, in that epenthesis applies so as to form a light syllable, even though formation of a heavy syllable (as in 74) is possible. (We saw in the preceding Section that the two-level account of syllabification correctly derives *wyksyka?hyy*.)

This problem occurs whenever a morpheme ending in a consonant cluster is followed by a CV sequence. Prosodic syllabification in these instances predicts that epenthesis will intervene between the consonants of the cluster, resulting in a heavy syllable. Instead, epenthesis occurs at the boundary, resulting in a light syllable. This is diagrammed below.

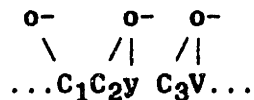
(76)

...C₁ C₂ * C₃ V...

Prosodic syllabification predicts:



Actual syllabification:



Note that this phenomenon is not particular to roots - suffixes in SSM may end in consonant clusters, but epenthesis can never apply morpheme-internally, even when prosodic syllabification would predict this.

Examples follow:⁹

(77)

manaX-Nk-keH-? (B82)

manaNkyke?

who was he?

?etla-lVmh-nHuk:u-: (B40)

?etlalamhynukkuu

he is making him ready to go home

We can conclude from this Section that prosodic syllabification cannot account for the patterns of syllabification and epenthesis exhibited by SSM. Only an approach which incorporates two distinct stages of syllabification can correctly account for the data.

-- Notes --

1. See also Harris (1991) for a similar analysis of Spanish.
2. For other analyses involving syllabification in stages, see Clements (1988), Dell and Elmedlaoui (1985, 1988), Green (1991a, 1991b), Harris (1991) and Idsardi (1991).
3. Harris (1991) proposes an analysis of syllable structure in Spanish in which C*V syllables are constructed cyclically (where 'C*' equals any permissible number of consonants including zero). As each new cycle is added, previously built syllables must be respected. In Harris' analysis, however, this is interpreted in a stricter sense than that used herein: previously built syllables are "fixed" in that onsets may not be added to previously onsetless syllables. It is possible that this difference in what it means to respect previously built structure derives from the amount of structure built at the early stage: SSM builds CV(X) syllables lexically and allows incorporation into such a syllable at the word-level; Spanish builds C*V syllables cyclically and does not allow incorporation into such syllables at later cycles.
4. This is in direct contrast to Ito's proposal, which crucially relies on syllabification being continuous; see Section 3.3 for discussion.

5. The phonemic sequence *ij* always surfaces as *i:*. The surface form is *halpakantii*.

6. I will demonstrate in Section 3.3 that Prosodic Syllabification (as proposed by Ito 1986, 1989) will derive **wykyska?hyy* (in which epenthesis occurs morpheme-internally) from *wyks-ka-?-hY:*.

7. See also Kiparsky (1979), Selkirk (1980, 1981), McCarthy (1979, 1981), Hayes (1980, 1982) and Prince (1983).

8. Note that this derivation departs from Ito in that it involves utilizing an x-tier and allowing reference to x-slots.

9. The 'X' in *manaX-* is a morphophoneme used by Broadbent which indicates that the following consonant will lengthen in certain environments. The vowel in the suffix *-lVmh-* is always a copy of the preceding vowel.

Chapter 4

Templates

In this Chapter, I discuss some of the interesting aspects of SSM templates and various issues which are raised with respect to the representation of templates. This Chapter is not intended to be a complete description of the templatic phenomena of the language.

Templates in SSM are a property of suffixes. A suffix can require the root to conform to a particular shape. SSM is similar to Yawelamani in this respect (cf. Archangeli 1982, 1983, forthcoming). The suffix *-paH-*, for example, requires the root to which it attaches to conform to the shape CVCCV. The root *mola:p-* 'to make mush' becomes *molpa-paH-* 'a good mush-maker'; *homuc-* 'razor' becomes *homcu-paH-* 'barber'. Section 4.1 discusses template-providing suffixes.

One of the intriguing features of SSM templates is that a suffixed root can sometimes itself undergo association to a template provided by a following suffix. The suffix *-N-*, for example, requires a CVCV: template; when it is suffixed to the root *peT:a-* 'to drop' it derives *peTa:-N-* 'to throw away; to lose'. This form can in turn be suffixed by *-kuH-*, which requires a CVCVC template, and the resulting form is *peTan-kuH-* 'obviously abandoned'. I claim that cases like this involve

reanalysis of a suffixed form as a root. The phenomena is discussed in Section 4.2.

A number of recent papers (Smith and Hermans 1982, Smith 1985, Lamontagne 1989) address an issue which could be referred to as "templatability". They suggest that roots in SSM can associate to a template only if the root, in its underlying form, belongs to a certain shape class. If the root falls outside of this class (generally, if it contains more than two syllables) it will not conform to the template required by the following suffix; rather, the suffix will concatenate linearly with the root with no change in shape involved. Thus, some roots are "templatable" and others are not. I argue in Section 4.3 that there is no such distinction in SSM. I demonstrate that monomorphemic bases of any shape can associate to a template and that polymorphemic bases cannot (unless they have undergone reanalysis).

Section 4.4 discusses the issue of the appropriate representation of templates. I argue that templates in SSM consist of a syllabified string of x-slots. The argument is based on the fact that SSM exhibits three distinct templates consisting of a light-heavy syllable sequence, which I refer to as CVCVC, CVCV: and CVCVX. A root with three consonants (pola:t) and a root with two consonants (ko:l) derive the following patterns in conjunction with these templates:

(1)	CVCVC	CVCV:	CVCVX
polat	polat	polaa	polat
ko:i	kolu?	koluu	koluu

In order to account for these template shapes, I propose that templates must be able to distinguish a branching from a non-branching Nucleus and a floating from a non-floating x-slot. McCarthy and Prince (to appear) argue, based on Arabic templatic data, that the distinction between a branching and non-branching Nucleus is not required in phonology. (They propose a moraic model of prosodic organization in which this distinction is unstateable.) I discuss their analysis of Arabic and demonstrate that their arguments cannot be extended to SSM, where this distinction is necessary. This constitutes a strong argument in favor of an x-slot model of phonological representation.

4.1 Templates as a Property of the Suffix

It is a property of many suffixes in SSM that the roots to which they attach must assume a particular shape (as in Yawelmani; see Archangeli 1983, 1984, forthcoming). These suffixes provide a lexically-specified template to which the root phonemes associate. The nominal suffix -iH- 'habitual', for example, combines with a root of the shape CVC:VC, as shown below.

(2)	
hal:ik-iH-h:Y-? (B102)	hul:uw-iH-te-? (B103)
hallikihhy?	hulluwiite?
he used to hunt	I'm always hungry

compare to:

halik-meh-nY-haHk-te-? (B101)	hulYw?-ksY-
halikmehnyhakte?	huluw?uksu-
I was hunting on my way	to look hungry

When the melody of an SSM root is insufficient to fill all the slots of a template, the default consonant (?) and vowel (/Y/) will fill in the empty slots. The root *lo:t-* 'to catch' with the template CVCVC is *lotu?-*; the root *lak-h* 'to appear' with the template CVCCV is *lakhy-*. Note that this is consistent with a left-to-right direction of association, as shown below.

(3)

	L -> R	R -> L
Association:	C V C V C : l o t	C V C V C l o t
Default:	C V C V C l o t u ?	* C V C V C ? u l o t

Below are examples of the root *liw:a-* 'to talk' in combination with four different template-providing suffixes.

<p>(4)</p> <p><i>liwa-ksY-j-ni?</i> (B103) <i>liwaksyjni?</i> you will talk</p> <p><i>liwa?-peH-h:Y-?-koH</i> (B113) <i>liwa?pehhykoo</i> he used to make speeches for them</p>	<p><i>liw:a?-puT:-eH-?</i> (B172) <i>liwwa?puTTe?</i> keep on talking</p> <p><i>liwa:-mY-ni-?</i> (B58) <i>liwaamyni?</i> talk to him!</p>
---	--

This pattern is quite distinct from the templatic association found in Arabic, where the second consonant of a biliteral root will spread onto the C₃ position.

Suffixes in SSM can be divided into two types - suffixes which require the root to conform to a particular shape, like *-IH-*, and suffixes which

merely concatenate with the root. I call these template-providing and non-template-providing (or concatenating) suffixes respectively.

I use the slash notation for all template-providing suffixes - on the right of the slash is the shape that the template requires the root to conform to. Two additional examples of template-providing suffixes follow.

(5)

-paH-/CVCCV 'agentive'
 molpa-paH- 'a good mush-maker'
 cf. mola:p- 'to make mush'
 halki-paH- 'a good hunter'
 cf. halik-peH- 'hunter'
 sik?e-paH- 'one who has ashes on him'
 cf. sik:e- 'ashes'
 mahko-paH- 'Friday'
 cf. mahok-nY- 'to be five'
 homcu-paH- 'barber'
 cf. homuc-:a-po- 'razor'

(6)

-kuH-/CVCVC 'evidential passive predicative'
 helaj-kuH- 'obviously scared'
 cf. hel:aja-m:a- 'coward'
 juwal-kuH- 'stirred'
 cf. juwa:l- 'to stir'
 lotu?-kuH- 'captive'
 cf. lotu-ksY- 'to hold down, tr.'
 wykys-kuH- 'someone evidently went'
 cf. wy:kys-e:-nY- 'to go back and forth'
 ?eleN-kuH- 'divorced'
 cf. ?e:leN-nY- 'to leave several things
 behind'
 cymy?-kuH- 'ridden'
 cf. cymy:-ma- 'rider; one riding'

Some suffixes subcategorize for two or more templates, creating minimal pairs of the sort below. As we can see, the different templates are associated with distinct meanings.

(7)

?elNe-pa-ksY-	'to be left; to be unable to go, although one would like to'
?ele:N-pa-ksY-	'to be left behind involuntarily, although one could go'
syk?y?-nY-	'to write here and there'
sy:ky?-nY-	'to write something down repeatedly'
joh-meh-nY-	'to kill on one's way (indefinite object)'
johu:-meh-nY-	'to kill on one's way (definite object)'
wyn-kuH-	'someone obviously walked there'
wyny?-kuH-	'someone is evidently going that way again'

An example of a concatenating suffix is *-poksu-*. This suffix does not require the root to conform to any particular shape. Below are examples of *-poksu-* following roots of a number of different shapes.

(8)

-poksu-	'reflexive'
komta-	'to hit with the fist'
komta-poksu-	'to hit oneself'
	cf. komta:-nY- 'to hit repeatedly'
tel:a-	'to paint; to dye; to decorate'
tel:a-poksu-	'to paint one's face'
	cf. tela? -:a- 'paint'
jo:h-	'to kill'
jo:h-poksu-	'to kill oneself'
	cf. joh-na- 'to kill for someone'
hupi:l-	'to cover the head; to put on a headdress'
hupi:l-po:ksu-	'to put on a headdress'
	cf. hupil -:a-Te- 'headdress'

Notice that the roots in SSM are associated underlyingly with a particular shape. The word meaning 'to paint' has the underlying shape CVC:V - when suffixed by *-poksu-* it retains this shape; when suffixed by *-:a-/CVCVC* it conforms to the shape requirements of this suffix. This is quite different from templatic languages like Arabic in which roots

consist of a string of phonemes which have no independent structure. The underlying shape of any particular root in SSM can be determined by suffixing it with a concatenating suffix. Since such suffixes have no associated template the root will appear in its underlying form.

4.2 Reanalyzed Roots

A template-providing suffix, when attached to a root, requires the root to conform to the template shape. When a template-providing suffix is added to a root that has already been suffixed, however, no shape-variation takes place - the suffixes are merely concatenated. This is demonstrated in the examples below.

(9)

-c:-e-/CVCCV

nocu: 'to cry'
 noc?u-c:-e- 'one who always cries'

but:

heniHl-NHe- 'to get lost'
 henihl-NHe-c:-e- 'one who always gets lost'

(10)

-lVmh-/CVCCV 'to be ready to ...'
 -nHuk:u-/CVCVC 'causative'

?eta:l- 'to return'
 ?etla-lVmh- 'to be ready to return'
 ?etal-nHuk:u- 'to take someone home'

but:

?etla-lVmh-nHuk:u- 'to make someone ready to return'
 ?etal-nHuk:u-lVmh- 'to be ready to take someone home'

Despite the above, however, a root + suffix is itself often subject to shape-variation. In cases like this, the root and suffix together act as a base for the following suffix and conform to the required shape. This is demonstrated below.

(11)
-h-/CVC

cun-h- 'to slide down' (cf. cu:n- 'to settle to the bottom')

-:a-/CVC:VC
cun:uh-:a- 'the place where (it) always falls'

The root *cu:n-* combines with the suffix to derive *cun-h-*, and then this bimorphemic form acts as a root for the suffix *-:a-/CVC:VC*. There are six suffixes in SSM which take a CVC template, listed below.

(12)

-h-/CVC	'transitional'
-ja-/CVC	'iterative'
-ku-/CVC	'refers to action of a damaging nature'
-la-/CVC	'to ... (it) in fragments'
-wa-/CVC	'iterative'
-ki-/CVC	[meaning not obvious]

These suffixes are not productive, and normally combine with roots of the shape CV:C-. In many cases, the roots with which they combine cannot occur independently as roots. An example follows.

(13)

-ki-/CVC

hal-ki- 'to hunt' (cf. hal-pa 'to find')

-meh-nY-/CVCVC

halik-meh-nY- 'to hunt on one's way'

-paH-/CVCCV

halki-paH- 'a good hunter'

-te:-nY-/CV:CVC

ha:lik-te:-nY- 'to hunt along the trail'

-iH-/CVC:VC

hal:ik-iH- 'habitual hunter'

The suffix *-ki-/CVC* combines with a root to form *hal-ki-* 'to hunt'. This root is only found in combination with *-ki-* and *-pa-*.¹ When *hal-ki-* is suffixed by a template-providing suffix, it behaves like a monomorphemic root of the shape CVCCV. For example, when suffixed by *-te:-nY-/CV:CVC*, *hal-ki-* takes the same shape as the monomorphemic root *?unpu-* 'to chase':

(14)

hal-ki- 'to hunt'

ha:lik-te:-nY- 'to hunt along the trail'

?enpu- 'to chase'

?e:nup-te:-nY- 'to chase along behind'

I assume that these are instances of reanalyzed roots. The root plus suffix is in turn analyzed as a root and can then undergo shape variation when suffixed by a template-providing suffix. Lamontagne (1989) has a similar analysis. He assumes, however, that such reanalysis is limited to those suffixes listed in 12 and that the reanalyzed root has been lexicalized. This is supported by the fact

that many of these roots do not occur in isolation. While some of these reanalyzed roots (such as *hal-ki-*) may indeed be lexicalized as such, I assume that reanalysis is a productive property of SSM. This is based on the fact that reanalysis occurs as well with very productive suffixes in SSM, most of which require the CVCV: template. Examples of this follow.

(15)

-ka:l- 'to kick with the heel'

a.

kal?y?-nY- 'to kick here and there'

kal:i-j:- 'to be kicking'

ka:l-NHe- 'to get kicked by a mule or a horse'

kal-ja- 'to kick all over'

b.

kala:-N- 'to dance'

-aH-/CVC:VC

kal:aN-aH- 'a dance'

-hHi-/CVCCV

kalNa-hHi- 'it makes one want to dance'

nY-/CVCVC

kalaN-nY- 'to dance for'

We can see from the words in 15a that this root is very productive. In 15b, the root is shown affixed by *-N-/CVCV:*, and as a reanalyzed root in combination with three different template-providing suffixes. I assume that one of the properties of the suffix *-N-/CVCV:* is that the suffixed form can undergo reanalysis.²

Other suffixes with this property are *-t-/CVCV:* and *-nY-/CVCV:*, as shown below.

(16)

a.

paTyH- 'to carry in one's arms'
paTy?-h- 'to have something with one'
paTy:-ma- 'bringer'

b.

paTy:-T- 'to take, accept; to carry'

-:a-/CVCVC

paTyT-:a- 'stock of gun'

-:a-/CVC:VC

paT:yt-:a- 'for carrying in'

(17)

a.

sik:e-paH- 'a twinge of pain; hurt feelings'
sik:e-pa-ksY- 'to hurt, intr.; to be painful'

b.

sike:-nY- 'to be sick'

-meH-/CVCVC

siken-meH- 'sick; an invalid'

-aH-/CVCV:C

sike:n-aH- 'sickness'

Some roots in SSM can be seen in more than one reanalyzed form. The root *peT:a-* can be suffixed by *-ja-/CVC* and by *-N-/CVCV:* - both of these can then be reanalyzed as roots, as shown in the following example:

(18)
-ja-/CVC
peT-ja- 'to drop several things' (cf. peT:a- 'to drop,
tr.')

-te:-nY-/CV:CVC
pe:Taj-te:-nY- 'to string out, tr.'

-N-/CVCV:
peTa:-N- 'to throw away; to lose'

-:a-/CVC:VC
peT:aN-:a- 'garbage dump'

-kuH-/CVCVC
peTaN-kuH- 'obviously abandoned'

Sometimes a reanalyzed root can be suffixed and, in turn, reanalyzed.

An example of this follows.

- (19)
a.
mi- 'what?' Demonstrative root
b.
mi-c:- 'to do what?'
c.
micy?-meH- 'for how long?; how far?'
micy?-:a- 'what is it for?'
micy-ksY- 'to be how?'
d.
micyk-na- 'to say what?; to do how?'
micyk-pa-ni-t 'how can it be that way?'

The demonstrative root in 19a is suffixed by the concatenating suffix -
c:- in 19b. This form is then reanalyzed as a root as demonstrated by
the examples in 19c. The final example in 19c, *micy-ksY-* is reanalyzed
as a root, as we can see from the example in 19d.³

4.3 Templatable Bases

One of the aspects of SSM templates which has intrigued phonologists is the fact that certain suffixes of SSM appear to sometimes require that the base fit a certain shape and sometimes simply concatenate with a base (cf. Smith and Hermans 1982, Smith 1985, Lamontagne 1989). Lamontagne goes as far as to claim that there are three distinct word formation processes in SSM. Suffixes, he claims, fall into three categories: those which (i) concatenate linearly with the base, (ii) always require that the base conforms to a particular shape requirement, and (iii) suffixes which either cause the base to conform to a particular shape or concatenate with the base.

This claim stems from Broadbent's descriptions of shape distinctions and suffix behavior. In order to determine what the facts are, we have to look in some detail at Broadbent's terminology. There are many different templatic shapes in SSM. Many of them she describes using a CV-notation, as in 'CVC:VCV', the template required by the suffix *-m:a-*. Four of these stem types, however, she refers to Stem 1, Stem 2, Stem 3 and Stem 4. She gives a chart to demonstrate these, as below.

(20)

English	Stem 1	Stem 2	Stem 3	Stem 4
to catch	lo:t-	lot-	lot:o?-	lot?u-
to come	?yn:-	?ynyh-	?yn:y?-	?yn?y-
to appear	lak-h-	lakyh-	lak:yh-	lakhy-
to be ashamed	mus:a-	musah-	mus:a?-	mus?a-
to bump into	kowta-	kowat-	kow:at-	kowta-
to arrive	hy:ja-	hyjah-	hyj:a?-	hyj?a-
to cry	nocuH-	nocuh-	noc:u?-	noc?u-
to ask	hasu:l-	hasul-	has:ul-	haslu-

Stems 2, 3 and 4 are the template shapes CVCVC, CVC:VC and CVCCV, respectively. Stem 1 forms are the underlying root shapes from which the other stem types are derived. Broadbent writes:

"The feature which distinguishes stems from structural units of other types is their occurrence in variant forms, having the same meaning and composed of the same segmental phonemes in differing but predictable arrangements, whose usage is determined by the nature of the first following suffix. This situation can be looked at in another way: part of the form of each suffix is the canonical shape of the stem which it follows.

Bases of certain types of canonical forms are also stems, as noted previously [...] The forms in question are as follows: [CV:, CVCC, CVCVH, CVCCV and CVCV:C] A base having any of these shapes is here referred to as a Stem 1. Where such a stem exists, it provides the most convenient basic form, since the rules of stem variation can be stated in such a way that other variants can be predicted from Stem 1, while the reverse is not true. This follows from the fact that Stem 1, which has five possible canons, exhibits the greatest diversity of shape; other stem types have no more than two." Broadbent 1964, pp. 37-8.

Broadbent's descriptions of suffixes make reference to these stem types. The description of the suffix combination *-le:-nY* includes the statement "[t]his suffix follows a Stem 4"; from this statement, and from the examples, I classify this suffix using the slash notation as *-le:-nY-/CVCCV*. These descriptions can be quite complex. A few examples follow:

(21)
-e:-nY-

"This combination of suffixes follows a stem of the form $C_1V_1:C_2V_2C_3-$, related to a verbal base, or to a nominal theme referring to a body part. Where necessary, the C_3 position is filled by /?/." (p. 78)

(22)
-j:a-

"This suffix follows a stem of the form of Stem 4 (C₁V₁C₂C₃V₂-) which is, however, related to a Class III nominal theme rather than to a Stem 1. Where necessary, the C₃ position is filled by /?/. If the related nominal theme has three or more syllables, only the first two are represented in this stem." (p.104)

The issue being addressed in the Section arises from a statement which Broadbent uses in the description of many suffixes, to the effect that a suffix will either follow a certain stem type or follow a base which is "too long" to be a Stem 1. An example is the suffix *-mh-* 'absent' which she describes as follows: "This suffix follows a Stem 4 or a base that does not fall within the canonical limits of Stem 1" (p. 74). Examples of this suffix follow. The cases in 23a are Stem 4 forms (CVCCV); in 23b is the one case that she cites as a "long" base.

(23)

a.

hywta-mh-eH-ti: 'let's run away' cf. hywa:-t- 'to run'
welhy-mh- 'to be away seeking' cf. wel-h- 'to seek'

b.

le:le:-nY-mh- 'to be away at school' cf. le:le:-nY- 'to read'

The cases in 23a both contain reanalyzed roots (which are treated as monomorphemic roots). The case in 23b is a bimorphemic base which is not subject to reanalysis.⁴

It is based on these descriptions used by Broadbent that Lamontagne (1989) (see also Smith and Hermans 1982 and Smith 1985) conclude that bases of certain shapes are subject to shape variation (conformation to a template) while bases of other shapes are not.

Lamontagne develops an account of this process which attempts to predict which types of bases will undergo shape variation and which will not. He notes that, subject to extrametricality of the final mora, bases which undergo suffix-triggered variation (those which Broadbent refers to as Stem 1) contain precisely two moras.⁵ He writes:

"By assuming that prosodic structure plays a role in the operation of morphological processes, we are able to provide a very restricted characterization of the domain to which suffix-triggered variation applies: it applies only to roots which, subject to extrametricality, are no bigger (or smaller) than the (bimoraic) trochee." (p. 33)

It is my belief that Broadbent's statements about this phenomenon have been misinterpreted. A careful study of the templatic data shows that monomorphemic bases (roots) are capable of conforming to a template and polymorphemic bases are not. The exceptions to this are just those forms in which reanalysis applies (in which case, the reanalyzed root is treated as monomorphemic). There is no distinction between underlying shapes which are able to associate to a template and those which are not. In other words, there is no notion of a "templatable" base.

Evidence for this claim comes from three sets of facts: (i) all bases which Broadbent describes as "outside the canonical limits of Stem 1" are polymorphemic (with one exception, discussed below), (ii) nominal themes undergo conformation to a template even though they do not fit the Stem 1 shape requirements, and (iii) there is ample evidence in the grammar of "long" bases undergoing conformation to a template. These are discussed below.

4.3.1 Polymorphemic bases

There are a great many suffixes for which Broadbent notes that concatenation will occur if the base does not fit the requirements of a Stem 1. For each of these, she gives examples of the suffix occurring with bases that have been associated to the appropriate template, and examples of bases to which the suffix merely concatenates. In every case (with one exception) the bases to which the suffix concatenates are polymorphemic. The bases which conform to the required template are either monomorphemic roots or reanalyzed roots. (Note that the set of reanalyzed roots involving the shape CVCV:-C, for which there are abundant examples, fall outside of the requirements for Stem 1. Thus, it is not enough to state that reanalysis only occurs when the resulting reanalyzed root would qualify as a Stem 1.)

The one exception is the root *tawhan:e-* 'to work', in combination with the suffix *-na-/CVCVX* which results in *tawhan:e-na-* 'to work for'. We can see from examining the dictionary entries for this root that this is a generally exceptional form. The root is borrowed from the Spanish *trabajar*. The dictionary lists three separate forms meaning 'to work'; each involves a slight variation in how the word was borrowed, *tawhan:e-*, *tawhan-nY-* and *tawhal-nY-*. More importantly, the three separate entries are credited to three distinct informants - apparently there was no agreement between informants on the appropriate form of this word. Given that this is the only example in Broadbent's grammar of a monomorphemic form presumably failing to undergo association to a

template because of its shape, I conclude that the description of the facts is incorrect. The generalization is, in fact, that polymorphemic bases do not undergo association to a template, while monomorphemic bases do.

4.3.2 Nominal themes

Many of the suffixes in question have a description that specifically mentions nominal themes, as in the description of the suffix -paH-/CVCCV, below.

"This suffix follows a Stem 4 or a stem of similar form related to a nominal theme, or a base too long to fit the canonical requirements of Stem 1." (p. 112)

Examples follow.

(24)
-paH-

a. with a Stem 4:

hel?y-paH-te-? 'I am a good fighter' cf. he:l- 'to fight'
sik?e-paH 'one who has ashes on him' cf. sik:e- 'ashes'

b. with a stem of similar form related to a nominal theme:

mahko-paH- 'Friday' cf. mah:oka 'five'

c. with a base too long to be a Stem 1:

?yhyT-meH-nY-paH- 'one who always gets angry'
cf. ?yhyT-meH-nY- to get angry'

As we can see in 24a, monomorphemic Stem 1 roots undergo association to the CVCCV template. In 24c is an example of a polymorphemic base -- here the suffix merely concatenates with the base. In 24b, however, is a

case of a monomorphemic root, which is not a Stem 1, conforming to the CVCCV template. In doing so, the final consonant of the root is lost (it cannot associate to the template as there is no room and it later deletes). This is thus an instance of a root which fall outside of the shape requirements of a Stem 1 but which still undergoes conformation to a template.

Broadbent writes:

"Monomorphemic nominal themes are quite numerous. [...] They show much greater diversity of form than do monomorphemic verbal bases, which all fall within the canonical limitations of Stem 1." (p.91)

Suffixes which only attach to verbal themes will either attach to a monomorphemic verbal theme (which will, as pointed out in the above quote, be a Stem 1) or a polymorphemic verbal theme. In the former case, the base will conform to the template required by the suffix; in the latter case, the suffix will concatenate with the base.

Suffixes which attach to nominal themes, or to both nominal and verbal themes, exhibit the following patterns. If they attach to a monomorphemic theme, the base will conform to the required template, even though, in the case of the nominal themes, this will involve shapes that do not correspond to Stem 1 shapes. If they attach to polymorphemic themes the suffix will concatenate.

4.3.3 Shape variation in "long" bases

Lamontagne claims that suffix-triggered variation applies to only those roots which satisfy a minimal foot template (i.e. which have two moras, subject to final mora extrametricality). Bases which are "longer" than this template will remain shape-invariant. He writes:

"We can now explain why trisyllabic roots are not subject to suffix triggered variation. These roots [...] will contain (at least) one mora more than that allowed by the [minimal foot] Since such roots are in excess of this template, they cannot serve as the domain of this morphological process. Likewise, we are able to explain why certain disyllabic roots do not undergo suffix-triggered variation. For example, the disyllabic root 'CVCCVC' will contain no less than three moras after the extrametrical material has been factored out.." (p. 33)

This claim, however, is contrary to fact. There are many examples of monomorphemic trisyllabic bases and of CVCCVC roots which undergo shape-variation. An example follows.

- (25)
hum:ele- 'old man'
- a.
hum:ele-c:Y- 'little old man'
hum:ele-t:i- 'little man'
- b.
humle-j:a-t:i- 'little old ones'

We can see from the words in 25a, which involve non-template-providing suffixes, that the underlying shape of the root is CVC:VCV. This root is, according to Lamontagne, too long to undergo shape-variation. We can see in 25b, however, that it conforms to the template requirements of a following suffix (here, -j:a-/CVCCV).

Other examples of shape-variation in "long" monomorphemic bases follow.

(26)

cyk:aka-	'rough-textured'
cykak-na-	'to roughen, tr.'
hinep:u-	'ripe'
hinep-na-	'to bake'
hul:iwi-	'short'
huliw-na-	'to make it short'
tolo:kot-	'three'
tolko:-pa-	'to be or do three times'
?yhy:maTi-	'bear'
?yhmy-j:a-	'bears'
putkal-	'guts'
put:aka-m:a-	'a fat man'
wila:toH-	'tall'
wilat-nHi-paH-	'tallest'

The above words are all part of the native Miwok vocabulary. Many words borrowed from Spanish contain three or more syllables. These forms undergo shape-variation as well, as seen in the following examples.

(27)

kawa:ju-	'horse'	(fr. Sp. caballo)
kawja-meH-	'one who has a lot of horses'	
mu:sika-	'music; musical instrument'	(fr. Sp.
musica)		
muski-paH-	'good musician'	
saru:ca-	'crosscut saw'	(fr. Sp. serrucho)
sarus-nY-	'to saw'	

We can conclude from this Section that the facts attributed to SSM concerning "templatability" are false. Monomorphemic bases of any shape undergo shape variation; polymorphemic bases do not. Reanalyzed roots act as monomorphemic in this respect. Whether or not a particular root

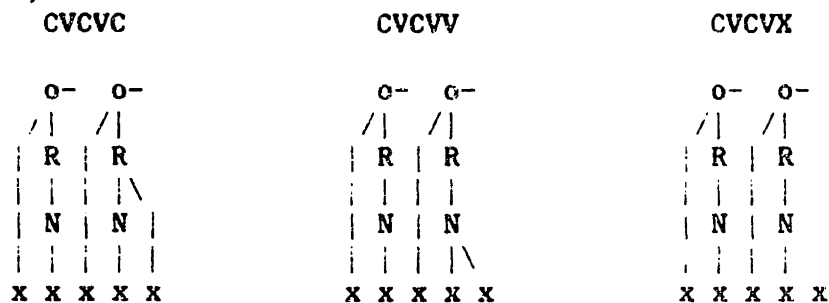
- suffix combination can be reanalyzed is a property of the suffix involved and does not directly derive from the shape of the root - suffix combination.

4.4 The Representation of Templates

In this Section, I argue that SSM templates (i) consist of a (partially) syllabified string of x-slots and (ii) must be distinguished by whether or not the heavy syllable contains a branching or non-branching nucleus.

I demonstrate herein that there are three distinct light-heavy templates in SSM. In one template the heavy syllable must be CVC and the final template slot will be filled by a default glottal stop when the root contains only two consonants. A second template requires the heavy syllable to be CVV, with the result that the third consonant of a trilateral root will remain unassociated (and later delete). Yet another template allows variation in the heavy syllable - it is CVC for trilateral roots and CVV for biliteral roots. I refer to this last pattern as CVX. I argue herein that these templates have the three distinct representations below.

(28)



As we can see from the above, templates in SSM must distinguish between a branching and a non-branching nucleus and between floating and non-floating x-slots.

The Section is organized as follows. In 4.4.1 I discuss the three light-heavy templates of SSM and show that they are indeed distinct. In 4.4.2 I argue that the representations of the three templates must make reference to a branching or non-branching nucleus and must distinguish between a syllabified and floating x-slot. 4.4.3 examines McCarthy & Prince's (to appear) account of Arabic templates, for which they claim that the distinction between CVC and CVV syllables is unnecessary. This is followed by a comparison of the SSM and Arabic systems from which I conclude that McCarthy & Prince's analysis of Arabic cannot be extended to SSM, and that the distinction between CVV and CVC (unstatable in moraic models) is necessary to an analysis of the SSM data.

4.4.1 The Light-Heavy Templates

4.4.1.1 The template CVCVC

Many suffixes in SSM provide the template CVCVC. If a root only contains two consonants a default glottal stop will appear in the C₃ position. An example is the suffix *-kuH-* 'evidential passive predicative', given below. 29a gives examples of trilateral roots and 29b of biliteral roots.⁶

(29)

-kuH-/CVCVC

a. wykys-kuH- 'someone evidently went'

cf. wyks- 'to go'
wyksy-lVmh-nHuk:u- 'to make someone ready to go'
wy:kys-e:-nY- 'to go back and forth'

?amal-kuH- 'crippled'

cf. ?am-la- 'to wound non-fatally'
?am-la-NHe- 'to die of wounds'

?eleN-kuH- 'divorced'

cf. ?eHl-NHe- 'to leave, tr.; to abandon'
?ele:N-pa-ksY- 'to be left against one's will'
?e:leN-nY- 'to leave several things behind'
?eHl-NHe-meh-nY- 'to get left behind'

b. lotu?-kuH- 'captive'

cf. lo:t- 'to catch; to grasp; to grab'
lot-wa-NHe- 'to get caught, of several
individuals'
lotu-ksY- 'to hold down, tr.'

wyny?-kuH- 'someone is evidently going that way again'

cf. wy:n- 'to walk'
wyn-ka-j-nY- 'to walk around'
wyn-si 'to go visiting'
wyn:y-c:- 'to walk around'

cymy?-kuH- 'ridden'

cf. cy:m- 'to climb; to ride'
cymcym-nY- 'to climb around here and there in
trees'

cymy?-hi:-me- 'one who has already been ridden'
cymy:-ma- 'rider; one riding'

In 29a are examples of trilateral roots in combination with -kuH-/CVCVC.

The root *wyks*, for example, in combination with this suffix becomes *wykys-kuH-*. This root is found in combination with suffixes providing

other templatic shapes, for example the suffixes *-lVmh-/CVCCV* "to be ready to..." and *-e:-nY-/CV:CVC* 'discontinuous iterative'.

The last two examples in 29a are both of re-analyzed roots. For example, the root *?am:u-* 'to hurt, tr.' combines with the suffix *-la-CVC* to form *?am-la-* 'to cripple; to wound non-fatally.' This suffixed form can then be reanalyzed as a root (such that the root contains the three consonants *?,m,l*) and then conform to the requirements of a template-providing suffix, as seen by the form *?amal-kuH-*. Alternatively, it can be suffixed by a non-template providing suffix such as *-NHe-*, in which case simple concatenation occurs, as in *?am-la-NHe-*.

Biliteral roots with *-kuH-/CVCVC* are given in 29b. For roots of this type, the C_3 position of the template gets filled with a glottal stop, as in *lo:t-/lotu?-kuH-*.

Below are two additional examples of suffixes taking this template: *-meH-/CVCVC* and *-peH-/CVCVC*.⁷

(30)

-meH-/CVCVC "a person who is..."

a. ?eleN-meH- 'a widower'

cf. (examples in 29a above)

Tosuj-meH- 'thin, scrawny'

cf. Tosj- 'to get thin'
Tos:uju-m:a- 'thin'

?yph-meH- 'Christian; baptized ("bathed")'

cf. ?yp-h- 'to swim around; to bathe'
?yp:yh-a- 'bathtub; swimming pool'

b. pele?-meH- 'blind person'

cf. pel:e- 'to not see; to be blind'
pele:-j- 'to pass unseen'

lotu?-meH- 'a captive'

cf. (examples in 29b above)

Tawy?-meH- 'liar'

cf. Tawy:-pa- 'to lie to someone'
Taw?y-j:- 'to tell lies all the time'
Taw:y?y-m:a- 'liar'

(31)

-peH-/CVCVC 'agentive'

a. halik-peH- 'hunter'

cf. hal-ki- 'to hunt'
hal-ki:-?ek 'he was hunting'
hal:ik-iH-h:Y-? 'he used to hunt'

?okoj-peH- 'a nurse'

cf. ?oko:j- 'to care for; to nurse; to protect; to give
first aid to; to put away leftovers'
?oko:j-haHk- 'a nurse'

kosen-peH- 'a cook'

cf. kose:-nY- 'to cook'
kosen:-a- 'kitchen'

b. liwa?-peH- 'speechmaker'

cf. liw:a- 'to talk; to tell something'
liw:a:-nY- 'to talk to someone'
liw:a?-puT:- 'to keep on talking'
liw:a?a-m:a- 'talkative'

hoja?-peH- 'the first one'

cf. ho:ja- 'to go first; to start first; to arrive first'
hoja:-na- 'to start for, tr.'

koto?-peH- 'guide'

cf. kot:o- 'to go on ahead'
koto:-na- 'to go ahead for someone else'
koto:-nHuk:u- 'to make someone go on ahead'

4.4.1.2 The template CVCVX

Another template which is exhibited in SSM is the one which I call CVCVX. This template has two surface variants: it is CVCVC when used

with a trilateral root and CVCV: when used with a biliteral root. An example is *-na-/CVCVX* 'benefactive', given below.

(32)

-na-/CVCVX 'benefactive'

a. *kojow-na-* 'to tell for someone'

cf. *kojo:w-* 'to tell news; to complain'

koj:owo-m:a- 'one who tells everything he hears'

?enyh-na- 'to make for'

cf. *?enh-* 'to make; to fix; to build; to prepare'

?enhy-paH- 'maker'

?enyh:-a- 'for making'

juwal-na- 'to stir for someone'

cf. *juwa:l-* 'to stir, tr.; to row'

juwal-kuH- 'stirred'

b. *heka:-na-* 'to clean for someone'

cf. *hek:a-* 'to wash, tr.; to wash away; to clean'

heka?-:a- 'dishcloth'

hek:a-poksu:-a- 'washrag ("for washing oneself")'

hoja:-na- 'to start for, tr.'

cf. *ho:ja-* 'to go first; to start first; to arrive first'

hoja?-peH- 'the first one'

hoja:-pa- 'to commence; to start on, tr.'

TeTy:-na- 'to gather for someone'

cf. *TeT-* 'to pick up, tr.; to gather acorns from the ground'

For trilateral roots, this template has the same surface realization as the CVCVC template discussed above. Thus, the root *juwa:l-* has the same shape when combined with either *-na-/CVCVX* or *-kuH-/CVCVC* as shown in 32a. For biliteral roots, however, the two templates are distinct. We

can see the distinction between the CVCVC and CVCVX templates for the root *ho:ja-* in 32b. When combined with the suffix *-peH-/CVCVC* the root surfaces as *hoja?-*; when combined with *-na-/CVCVX* it surfaces as *hoja:.* Similarly, *heka:-* combined with *-:a-/CVCVC* produces *heka?-* and with *-na-/CVCVX* produces *heka:-.* Examples like these demonstrate that the templates which I have called CVCVC and CVCVX are distinct.

Examples of two other suffixes requiring a CVCVX template follow:

(33)

-meh-nY-/CVCVX 'to ... on one's way'

a. *halik-meh-nY-* 'to hunt on one's way'

cf. *hal-ki-* 'to hunt'

hal-ki:-?ek 'he was hunting'

hal:ik-iH-h:Y-? 'he used to hunt'

halik-peH- 'hunter'

b. *juhu:-meh-nY-* 'to kill on one's way (def. object)'

cf. *jo:h-* 'to kill'

jo:h-poksu- 'to kill oneself'

joh:e?-HmetiH- 'Yosemite ("they are killers")'

joh?u?-nY- 'to kill here and there all over'

(34)
-nY-/CVCVX 'transitive; causative; benefactive'

a. kalaN-nY- 'to dance for'

cf. kala:-N- 'to dance'
kalNa- 'dance'
kal:aN-aH- 'dance'

wasyn-nY- 'to tell a story to'

cf. was-nY- 'to tell a story'
wasny-paH- 'storyteller'

b. liwa:-nY- 'to talk to'

cf. liw:a- 'to talk; to tell something'
liwa-ksY- 'to talk; to converse'
liw:a?-puT:- 'to keep on talking'
liw:a?a-m:a- 'talkative'

?ywy:-nY- 'to feed'

cf. ?yw:y- 'to eat'
?ywy?-kuH- 'partly eaten'
?ywy?:-aH- 'groceries'
?yw:y? -:a- 'stable ("place to eat");
something to eat'

Notice the contrast between ?ywy:-nY- and ?ywy?-kuH- in 34b. This demonstrates again the distinction between the CVCVX and CVCVC templates in biliteral roots.

The suffix -nY- can occur with a number of different templates; the meaning of the suffix depends on the template which it provides. Above is the suffix -nY-/CVCVX which has a transitive, causative or benefactive meaning. The suffix -nY- can also require CVCVC (-nY-/CVCVC) with the meaning "to ... secretly or inadvertently, while doing something else". This leads to the interesting contrast below:

- (35)
- | | | |
|------------|-----------|--|
| -nY-/CVCVX | ?ywy:-nY- | 'to feed' |
| -nY-/CVCVC | ?ywy?-nY- | 'to eat something (e.g.
an insect) inadvertently,
in one's food' |

4.4.1.3 The template CVCV:

A third light-heavy template exhibited in SSM is the CVCV: template. When a trilateral root is associated to this template the final root consonant does not associate to the template and is later deleted. An example of a suffix requiring this template is *-t-/CVCV:*, shown below.

(36)

-t-/CVCV: "to do what is characteristic of ..."

a. *hela:-t-poksu-* 'to be scared'

cf. *hela:j-* 'to scare, tr.'
helaj-kuH- 'obviously scared'
hel:aja-m:a- 'coward'

wyli:-t- 'to flash, of lightening'

cf. *wyli:p-* 'to flash, of lightening'
wylip-h--:nY- 'to shine in the dark'
wylip-:a- 'kindling'

pulu:-t- 'to dip up'

cf. *pult-* 'to dip into or out of water'

b. *paTy:-t-* 'to take, accept; to carry'

cf. *paTyH-* 'to carry in one's arms'
paTy-ksY- 'to possess'
paTy?-h- 'to have something with one'

moli:-t- 'to get dusk; to get late; to become evening'

cf. *mol:i-* 'shade'
moli-mh- 'to be cooling off in the shade'

The CVCV: template is distinct from the CVCVC template for both bi- and trilateral roots. We can see this for a trilateral root *hela:j-* in the forms *hela:-t-* and *helaj-kuH-* in 26a. For biliteral roots, this distinction is apparent in the forms *paTy:-t-* and *paTy?-h-* in 36b (the root *paTyH-* in combination with the suffixes *-t-/CVCV:* and *-h-/CVCVC*).

Below are two further examples of suffixes requiring the CVCV: template.⁸

(37)

-j-/CVCV: 'verbalizer'

a. ?elu:-j- 'to float in air'

cf. ?eltu- 'to float, not sink'
?elut-:a- 'a float'

b. ?oha:-j- 'to marry a woman'

cf. ?oh:a- woman; wife; female
?oh:a-TaH- 'little girl'
?oh:a:-nY- 'to become a woman'

haTe:-j- 'to make tracks'

cf. haT:e- 'foot; tracks; twelve inches'
haT?e-meH- 'one with big feet'
haT:e?-m- 'to go barefoot'

(38)

-jak-/CVCV: "times ten"

a. maho:-jak 'fifty'

cf. mah:oka- 'five'
mahko-paH- 'Friday'
mahok-nY- 'to be five'

temo:-jak 'sixty'

cf. tem:oka- 'six'
te:mok-nY- 'to be six'

b. keNe:-jak- 'another kind'

cf. keN:eH- 'one'
keN:eH-c:Y- 'only one'

?oTi:-jak- 'twenty'

cf. ?oTiH- 'two'
?oTiH-kene:-pa- 'double; twins'

Not only is the CVCV: template distinct from the CVCVC template as described above, but it is also distinct from the CVCVX template. This distinction is not apparent for biliteral roots which have the same surface forms in both CVCV: and CVCVX, but it is apparent for the triliterals. This can be seen in the pair below.

(39)

kojo:-nY- 'to tell to someone'

kojow-na- 'to tell for someone'

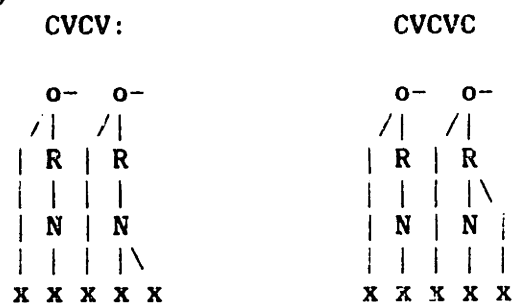
cf. kojo:w- 'to tell news; to complain'

koj:owo-m:a- 'one who tells everything he hears'

4.4.2 The Representation of the Light-Heavy Templates in SSM

Now that it has been established that these three templates are distinct, let us turn to the question of how to represent them. I propose that the CVCV: template contains a branching nucleus and that the CVCVC template contains a branching rhyme, as below:

(40)



To save space, I will suppress the rhyme in the following discussion.

The above templates will thus be represented as follows:

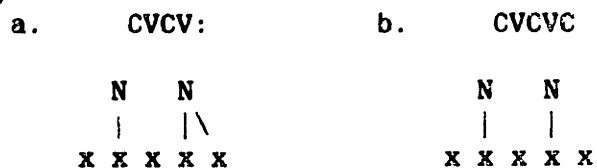
(41)



These templates consist of a string of x-slots that are fully syllabified. They are thus quite distinct from previously proposed templatic representations. Under CV-theory accounts (McCarthy 1979, Marantz 1982), a template consists of a string of Cs and Vs for which further structural information is unnecessary. X-theory accounts (Levin 1985) normally posit a string of skeletal slots that are either (i) unmarked with respect to structural information, or (ii) contain the minimal structural information of the position of the Nucleus.

The natural question to ask at this point is: why propose that the templates in SSM be fully syllabified, as above, when the only information necessary for distinguishing the CVCV: and CVCVC shapes is whether or not the Nucleus (of the second syllable) branches? In other words, we might ask whether the following templates are sufficient:

(42)



This is particularly so if we assume that the Linking Constraint (Hayes 1986), which interprets association lines in structural descriptions as exhaustive, applies to templatic representations. This would assure

that the final x-slot in the template in 42b must be associated with a consonant (thus accounting for the default glottal stop insertion that occurs when biliteral roots associate to this template).

The reason for proposing that the templates are syllabified has to do with the fact that there are three distinct light-heavy templates in SSM - CVCV:, CVCVC and CVCVX. The template in 42a can result only in the shape CVCV:. The template in 42b cannot, however, account for both the CVCVC and CVCVX patterns. I propose to represent this latter pattern with a template containing a final 'floating x-slot', as below:

(43)

```

      o-  o-
      /|  /|
      |  |  |  |
      |  N  |  N
      |  |  |  |
      x  x  x  x  x
  
```

Association to the template will result in the intermediate derivations below (the roots *kojo:w-* and *hek:a-* shown in combination with the suffix *-na-/CVCVX*):

(44)

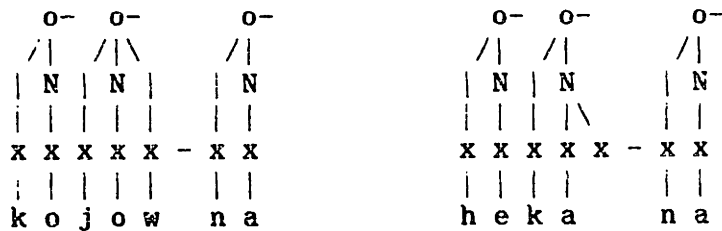
```

      o-  o-      o-      o-  o-      o-
      /|  /|      /|      /|  /|      /|
      |  |  |  |  |  |  |  |  |  |
      |  N  |  N  |  N  |  N  |  N
      |  |  |  |  |  |  |  |  |
      x  x  x  x  x  - x  x  x  x  x  x  - x  x
      |  |  |  |  |  |  |  |  |
      k  o  j  o  w  n  a  h  e  k  a  n  a
  
```

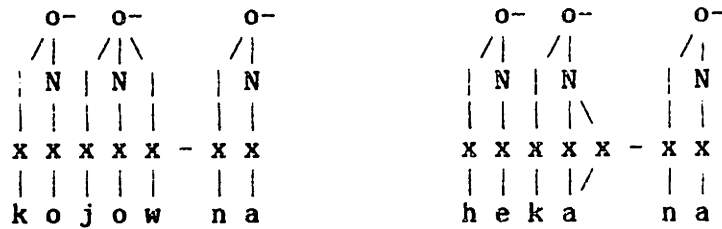
Word-level syllabification will incorporate the rightmost x-slot into the preceding syllable, and in the case of *hek:a-*, spreading will apply to produce the long vowel. This is shown below.

(45)

Word-level syllabification (applied to forms in 44):



Spreading:



Word-level syllabification scans the x-tier from the right and encounters the unsyllabified template-final x-slot. In the case of *kojo:w-* this slot is associated to a consonant, 'w', and will adjoin to the preceding syllable as a coda. In doing so, it adjoins to the rhyme node, creating a CVC syllable.

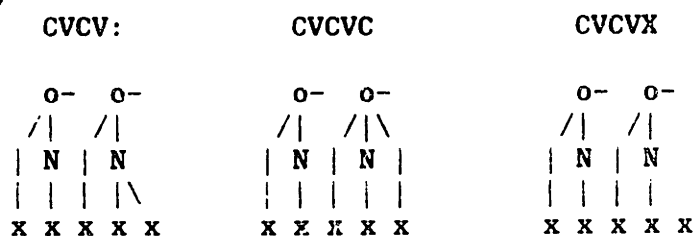
Notice that in the case of *hek:a-* word-level syllabification must adjoin the floating x-slot into the nucleus of the preceding syllable (in order to explain the surface long vowel). If it adjoined to the rhyme, we would expect a default glottal stop in this position and the template would then be indistinct from the CVCVC template.

A review of the syllabification data shows that when incorporating a floating x-slot (as opposed to an empty one) into a preceding syllable during word-level syllabification, the result is always a long vowel.⁹

Thus, I assume that incorporating into a preceding syllable in SSM always involves adjoining to the Nucleus unless the x-slot in question has phonemic content in which case it must adjoin to the rhyme.

The CVCVX template is thus distinguished from the two other light-heavy templates by the fact that the final x-slot is floating. Word-level syllabification will then attach this x-slot to either the Rhyme or Nucleus, depending on whether or not a root consonant has been associated to it. Note that, unless the templates are syllabified, there is no way of distinguishing a 'floating' x-slot from a non-floating slot in the templatic representation. The three distinct light-heavy templates thus have the three distinct representations below (where the rhyme has been suppressed):¹⁰

(46)



An important point to observe is that these templates reflect the lexical syllabification of SSM roots. Recall that morphemes in SSM are (partially) syllabified lexically. This partial syllabification consists of core (CV, CVV and CVC) syllables, and allows for peripheral floating x-slots or unsyllabified consonants. In a root, a peripheral (final) floating x-slot occurs when the final vowel of the root is alternating. This x-slot will surface as either vocalic or consonantal depending on the syllabification of the following string at the word-

level. This corresponds to the fact that the floating x-slot in the CVCVX template is sometimes associated with a consonant and sometimes with a vowel, depending on the root melody to which it is associated. Each of the template shapes above is thus syllabified in a way that corresponds to the lexical syllabification of morphemes.

I assume that templates in SSM are subject to the same syllabification restrictions as the lexical representations of morphemes. As an example, recall that non-peripheral floating x-slots are not allowed in SSM morphemes. I assume that templates are subject to this restriction as well. This correctly predicts that the three-way contrast between CVV, CVC and CVX can only be found template-finally, i.e. that a template like the one shown below would be ill-formed.

(47)

```

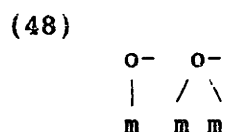
*      o-      o-
      /|      /|
      | N      | N
      | |      | |
      x x x x x

```

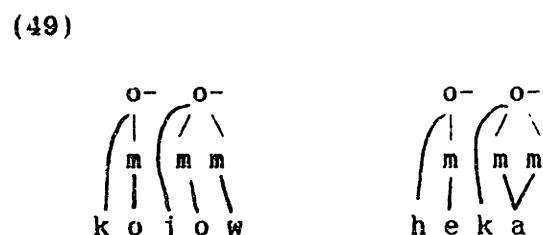
(In templates with an initial heavy syllable, this syllable is either obligatorily CVV or obligatorily CVC.)

The account that I have adopted here posits a distinct representation for each of the light-heavy templates of SSM. This distinction is not possible under a moraic model of prosodic organization. Moraic accounts (cf. McCarthy & Prince 1986, to appear a and b) represent templates as a prosodic constituent (eg. foot, minimal word, syllable) for which moraic count may be specified but which lack reference to segment-sized

skeletal units. The templates in 46 have an identical structure under a moraic account. This is because a moraic model of syllable structure can only distinguish syllables in terms of their weight (heavy vs. light) but are incapable of distinguishing between heavy CVC and CVV syllables. Each of the light-heavy templates in SSM would be represented by an iambic template, as below:



Note that this template will result in the CVCVX surface pattern. Triliteral roots will derive a CVCVC shape on association to this template, and biliteral roots a CVCVV shape, as below for the roots *kojo:w-* and *hek:a-*:



This template cannot correctly derive the form that results from associating a triliteral root with a CVCV: template shape (namely, that the vowel is long and the third root consonant does not associate). Furthermore, it cannot correctly derive the form that results from associating a biliteral root to a CVCVC template shape (namely, that the final moraic position of the template is filled with a default glottal stop).

A moraic account is unable to distinguish among these template shapes because it is unable to distinguish between CVC and CVV heavy syllables. McCarthy & Prince (to appear) address this issue with respect to Arabic templates and conclude that this inability to distinguish between the two types of heavy syllables is in fact an advantage of moraic theory. They write:

"It is now appropriate to turn to the question of template satisfaction: how are the root and skeleton associated with one another? This is of particular importance since moraic theory, unlike its CV theory predecessor, is unable to distinguish between the two types of heavy syllables Cvc and CvC. [footnote omitted - ks] It will emerge that the ability to make this distinction is a liability rather than an advantage of the CV theory, since Arabic grammar does not actively exploit this putative skeletal distinction." (p. 31)

Since, on the surface, Arabic appears to differentiate between CVC and CVV syllables, it behooves us to compare the Arabic and SSM templates with respect to this issue. In the next Section I examine McCarthy & Prince's account of the Arabic templates. I will show that their analysis does not extend to the SSM data, and conclude that the distinction between CVC and CVV syllables is indeed necessary in SSM, and hence must be part of UG.

4.4.3 Templates and the CVV/CVC Distinction

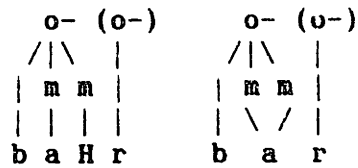
4.4.3.1 Arabic

Arabic has surface distinctions in CVV and CVC as demonstrated by pairs like *barr/baab*, *kaatib/xanjar* and *jabbaar/jaamuus*. McCarthy & Prince (to appear) (hereafter, M&P) are able to derive the various templates in Arabic, however, without reference to a distinction in CVV/CVC. They accomplish this through three avenues: (i) a distributional asymmetry in Arabic stems, (ii) the principle of Melody Conservation and (iii) a grammatically-triggered rule of Medial Gemination. These are reviewed briefly below.

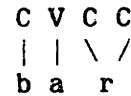
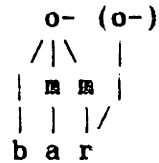
Monosyllabic stems in Arabic can be of the shape CvCC (*baHr* or *barr*) or CvvC (*baab*).¹¹ M&P point out that these are distinguished in a CV theory, but not in moraic theory, as below.¹² (Note that all stems in Arabic have a final extrametrical consonant; this is represented in M&P by a syllable enclosed within parentheses.)

(50)

Moraic Skeleton:



CV Skeleton:



M&P point out, however, that while CvCC stems are quite common in Arabic, CvvC stems are exceptions. In most cases, they claim, such stems arise from the application of regular phonological rules to stems of the shape /CawaC/ or /CayaC/ (evidenced by sg./plural alternations like *baab/?abwaab* 'door'). They conclude that monosyllabic noun stems should be obligatorily treated as CvCC.

A similar asymmetry is found in disyllabic noun stems. They note that, with a few exceptions, such stems always end in CvvC. They conclude:

"There is, then, no lexical distinction between the two types of heavy final syllables; stem-finally, a bimoraic syllable is necessarily CvC in monosyllables and Cvv in disyllables." (p. 32)

M&P then account for the surface patterns in nouns by positing a rule, Final Mora Association, which ensures that the final mora of a heavy syllable is associated to a consonant in monosyllabic words and to a vowel in disyllabic words. The rule is stated in terms of a minimal/super-minimal distinction, which, for the purposes of this

discussion is as follows: minimal = monosyllabic, super-minimal = disyllabic. The rule is stated as follows:

(51)
Final Mora Association

m]	if minimal, otherwise m]
C	v

Given the assymetrical distribution of CVC and CVV syllables in Arabic stems, they can derive the appropriate surface forms by use of this special association rule. A problem still remains, however, for stems which contrast a long vowel and medial gemination. M&P state:

"Within the noun, there is only one other locus where an apparent CvC/Cvv distinction is made: CvCCvvC medial geminates like jabbaar versus CvvCvvC nouns like jaamuus. The number of root consonants and the prosodic skeleta are identical in both cases; how then to account for the apparent contrast between a closed and heavy initial syllable?" (p. 33)

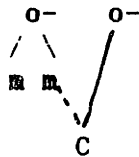
Note that this description of the problem points out quite well where potential problems to their analysis arise: if the prosodic skeleta are the same and the number of root consonants is the same, then association must result in identical surface forms unless some specific rule of the language (e.g. Final Mora Association) manipulates the association.

The reason for noting the number of root consonants in the above statement is that Arabic has a principle of Melody Conservation by which "maximization of melodic association takes absolute precedence over other considerations" (p. 32). Thus, the distinction between a CVVCVC

surface form (*kaatib*) vs. CVCCVC (*xanjar*) arises not from there being distinct templates but from melody conservation.

The approach that they take to the problem of medial gemination is to handle it by a grammatically-triggered rule of Medial Gemination which spreads an onset consonant onto a preceding mora. The rule follows:

(52)
Medial Gemination



Having medial gemination derived by rule, in combination with the asymmetry of the distribution of heavy syllables in final position and the principle of Melody Conservation, allows M&P to represent Arabic templates without reference to the distinction between CVV and CVC. I will demonstrate below that none of these hold of SSM, and that the distinction between CVV and CVC must be made in the SSM templates.

4.4.3.2 Comparison of Arabic and SSM

M&P are able to make use of a distributional asymmetry in Arabic stems to avoid reference to the internal makeup of a heavy syllable. No such asymmetry exists in SSM. This should already be clear from the description above of the light-heavy templates in SSM. A clear contrast is found between the templates CVCVV and CVCVC, thus showing a contrast in heavy syllables in template-final position. (The fact that SSM has a

three-way distinction in this position is even stronger evidence in favor of the need to specify the internal structure of the syllable.)

It is also very clear that the principle of Melody Conservation does not hold of SSM. In the templatic system of SSM, root consonants are regularly lost if there is no 'space' for them in the template. We saw this above for the template CVCV:. The third consonant of a trilateral root cannot associate to this template and is deleted, as in the example *?eltu-/?elu:-j-*. Furthermore, many roots in SSM contain four consonants; the final consonant surfaces when the root occurs with a non-template-providing suffix, but is lost upon association to a template. This is demonstrated by the pair below. (See Section 4.3 for more examples of this phenomenon.)

- (53)
 putkal- 'guts'
 put:aka-m:a- 'a fat person' (-ma-/CVC:VCV)

The lack of Melody Conservation in SSM is also apparent by the behavior of floating phonemes in the language (discussed in detail in Chapter 2). Recall that some suffixes contain a floating phoneme, such as *-ja:*, represented below.

- (54)
- $$\begin{array}{c} x \ x \\ \ \ \backslash / \\ j \ a \end{array}$$

The floating 'j' of the suffix will surface if it can be syllabified; otherwise it will delete. This is demonstrated below.

(55)
 /halpa-ja:-ni-:/ -> halpajaanii
 /he:l-ja:-ni-:/ -> heelaanii

The claim that I make herein is that phonemes which are unassociated to x-slots will undergo deletion if they cannot be incorporated into an adjacent syllable; they will never induce epenthesis. This distinction between floating and non-floating phonemes demonstrates that the lack of Melody Conservation is apparent in both the templatic and non-templatic phonologies of SSM.

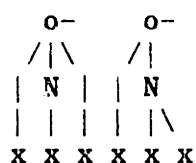
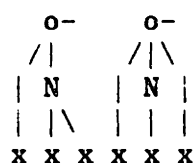
J&P argue that medial gemination be derived by rule. Thus, the distinction between CvvCvvC and CvCCvvC in Arabic is a derived distinction and does not result from distinct templates. In SSM, however, even if we assume that medial gemination is derived by rule, we still have to specify the internal structure of initial templatic heavy syllables. This is because, instead of having the two-way distinction found in Arabic, SSM once again exhibits a three-way distinction (though not of the type discussed above for light-heavy templates).

SSM has three templates exhibiting an initial heavy syllable: CV:CVC, CVC:VC and CVCCV:. A trilateral root, such as *mola:p-*, results in the following surface forms upon association to these templates: *moolap-*, *mollap-* and *molpaa*. If we were to account for the medial geminate by deriving it from the CV:CVC template by rule, we would still need to posit two distinct templates for the CV:CVC and CVCCV: templates, as below:

(56)

CV:CVC

CVCCV:



We can thus see that the facts about Arabic which allow M&P to avoid reference to the internal structure of heavy syllables do not extend to SSM. In addition, the fact that SSM has a three-way distinction between CVC, CVV and CVX makes reference to this internal structure a necessary and integral part of any analysis of SSM.

-- Notes --

1. The suffix *-pa-* is a fully productive suffix, occurring with shapes CVC and CVCVX (see following section for discussion of this latter template).

2. Lamontagne (1989) does not consider cases like this to be reanalysis because, in his account of SSM, monomorphemic roots of the shape CVCV:C cannot undergo shape-variation. A root of this shape, he claims, is "too long" to undergo association to a template and a template-providing suffix will merely concatenate with such a root (this is the topic of the following Section, and will be discussed in detail). Forms like *kala:-N-*, which are very common in SSM, are thus quite problematic for him.

3. Notice that the reanalyzed root *micy-ksY-* has four consonants, and that the final consonant is lost in association to a template in 19d. It is a standard property of SSM that root consonants are deleted if there is not enough room for them in the template. See Sections 4.3 and 4.4 and the comments on floating phonemes in Chapter 2 for more details.

4. Although the suffix *-nY-* is sometimes subject to reanalysis, this only occurs when *-nY-* is used in combination with the CVCV: template.

5. Lamontagne's account is more complicated than this statement implies. While CVCVC roots fit this description they are not Stem-1 forms; also, CVCV:C bases do undergo suffix-triggered variation even though they contain one mora too many by Lamontagne's formula. He must

then rule out CVCVC bases on independent grounds - he argues that roots of this shape do not have biplanar representations of consonants and vowels, and that only roots which do have biplanar representations may undergo suffix-triggered variation - and rule in CVCV:C bases, which he does by claiming that these roots are generally exceptional.

6. I am using the terms trilateral and biliteral, normally used in descriptions of Semitic roots, to note the number of consonants within the root. I will use this terminology even though SSM differs from Arabic in that the consonants of the root do not form an independent morpheme.

7. In 31b, I give the form *liwa?-peH-* 'speechmaker'. In the dictionary section of Broadbent's grammar this form is listed as *liwat-peH-*. It appears as if this dictionary entry is an instance of typographical error, as elsewhere in the grammar this form is consistently reported with a glottal stop in C₃ position (e.g. *liwa?-peH-te-?-koH* 'I am their speechmaker' B113 and *liwa?-peH-h:Y-?-koH* 'he used to make speeches for them' B113.)

8. The suffix *-jak-* is operable only in the number system of SSM. Number systems often exhibit exceptional morphology and I would hesitate to make a generalization based solely on the behavior of *-jak-*. As it substantiates a pattern observed by regular, productive suffixes, such as *-j-/CVCV:*, I include the data here.

9. Recall the distinction made in earlier Chapters: a floating x-slot has no phonemic content and is unsyllabified, an empty x-slot is one that is unsyllabified but that has phonemic content.

10. Notice that the floating x-slot in the CVCVX template is not filled during template association but rather via spreading after word-level syllabification has applied. This has consequences for the notion of Template Satisfaction. Perhaps it can be said that in SSM all syllabified slots in a template must be satisfied during association.

11. The 'H' in *baHr* is a standard notation for a guttural consonant in Arabic. It is not to be confused with Broadbent's 'H', which I have adopted herein, which notates alternating phonemes in SSM.

12. By the term 'CV theory', M&P refer to any one of a whole group of phonological theories that share these properties: (i) they have segment-sized skeletal elements and (ii) they are capable of distinguishing between CVV and CVC syllables. Neither of these properties hold of moraic theory.

References

- Archangeli, D. (1983) "The Root CV-Template as a Property of the suffix: Evidence from Yawelmani," *Natural Language and Linguistic Theory* 1, 347-384.
- Archangeli, D. (1984) *Underspecification in Yawelmani Phonology and Morphology*, PhD Dissertation, MIT, Cambridge, Mass, Published in 1988 by Garland Publishers, New York.
- Archangeli, D. (1985) "Yokuts Harmony: Evidence for Co-planar Representation in Nonlinear Phonology," *Linguistic Inquiry* 16.3.
- Archangeli, D. (forthcoming) "Prosodic Theory and Yawelmani Templates," to appear in *Natural Language and Linguistic Theory*.
- Barrett, S.A. (1908) "The Geography and Dialects of the Miwok Indians," *University of California Publications in American Archaeology and Ethnology*, Vol. 6, No. 2, pp. 333-368.
- Benjamin, G. (1976) "An Outline of Temiar Grammar," in Jenner et. al. (eds.) *Austroasiatic Studies*, Part I, University Press of Hawaii, Honolulu.
- Borowsky, T. (1985) "Empty and Unspecified Segments," in J. Goldsmith, S. Mackay and M. Westcoat, eds., *Proceedings of the West Coast Conference on Formal Linguistics 4*, Stanford Linguistics Association, Stanford CA.
- Broadbent, S. and C. Callaghan (1960) "Comparative Miwok: a Preliminary Survey," *International Journal of American Linguistics*, Vol. 26, pp. 301-316.
- Broadbent, S. (1964) *Southern Sierra Miwok Language*, University of California Publications in Linguistics, Vol. 38, University of California Press, Berkeley and Los Angeles, CA.
- Broselow, E. (1980) "Syllable Structure in Two Arabic Dialects," *Studies in the Linguistic Sciences* 10, 13-24.
- Broselow, E. (1982) "On Predicting the Interaction of Stress and Epenthesis," *Glossa*, Simon Fraser University, Burnaby, B.C. pp. 115-32.
- Clements, G.N. and S.J. Keyser (1983) *CV Phonology: A Generative Theory of the Syllable*, MIT Press, Cambridge, MA

- Dell, F. and M. Elmedlaoui (1985) "Syllabic Consonants and Syllabification in Imdlawn Tashlyt Berber," *Journal of African Languages and Linguistics* 7, 105-130.
- Dell, F. and M. Elmedlaoui (1988) "Syllabic Consonants in Berber: Some New Evidence," *Journal of African Languages and Linguistics* 10, 1-17.
- Dresher, E.B. and Lahiri, A. (1991) "The Germanic Foot: Metrical Coherence in Old English", *Linguistic Inquiry* 22, 251-286.
- Everett, D. and Seki, L. (1985) "Reduplication and CV Skeleta in Kamaiura" *Linguistic Inquiry* 16, 326-330.
- Freeland, L.S. (1951) *Language of Sierra Miwok*, Indiana University Publications in Anthropology and Linguistics, International Journal of American Linguistics Memoir 6.
- Freeland, L.S. and S. Broadbent (1960) "Central Sierra Miwok Dictionary (with texts)," *University of California Publications in Linguistics* Vol. 23, pp. 1-71.
- Goldsmith, J. (1976) *Autosegmental Phonology*, PhD Dissertation, MIT, Cambridge, MA
- Green, T. (1991a) "Against Syllable Quantity," ms. MIT, Cambridge, MA
- Green, T. (1991b) "Core Circumscription: A New Look at Muskogean," ms., MIT, Cambridge, MA.
- Halle, M. and J.-R. Vergnaud (1987) *An Essay on Stress*, MIT Press, Cambridge, MA
- Harris, J. (1991) "Integrity of Prosodic Constituents and the Domain of Syllabification Rules in Spanish and Catalan," ms., MIT, Cambridge, MA
- Hayes, B. (1980) *A Metrical Theory of Stress*, PhD Dissertation, MIT, Cambridge, MA
- Hayes, B. (1982) "Extrametricity and English Stress," *Linguistic Inquiry* 13, 227-276.
- Hayes, B. (1985) "Iambic and Trochaic Rhythm in Stress Rules," in M. Niepokuj et. al (eds.) *Proceedings of Berkeley Linguistics Society* 11, 429-446.
- Hayes, B. (1986) "Inalterability in CV Phonology," *Language* 62, 321-51.
- Hayes, B. (1989) "Compensatory Lengthening in Moraic Phonology," *Linguistic Inquiry* 20, 253-306.

- Hyman, L. (1985) *A Theory of Phonological Weight*, Foris Publications, Dordrecht.
- Idsardi, W. (1990) "Syllabification and Reduplication in Bella Coola," ms., MIT, Cambridge, MA
- Ito, J. (1986), *Syllable Theory in Prosodic Phonology*, PhD Dissertation, University of Massachusetts, Amherst, Published in 1988 by Garland Publishers, New York.
- Ito, J. (1989) "A Prosodic Theory of Epenthesis," *Natural Language and Linguistic Theory* 7, 217-259.
- Kenstowicz, M. (1985) "On Core Syllables in Modern Arabic Dialects," in R. Schuh (ed.) *Studies in African Linguistics*, Supplement 19, UCLA.
- Kiparsky, P. (1979) "Metrical Structure Assignment is Cyclic", *Linguistic Inquiry* 10, 421-441.
- Kiparsky, P. (1982) "Lexical Morphology and Phonology," in I.-S. Yang (ed.) *Linguistics in the Morning Calm*, Seoul, Manshin, 3-91.
- Kiparsky, P. (1985) "Some Consequences of Lexical Phonology," in C. Ewin and J. Andersen (eds) *Phonology Yearbook* 2, Cambridge University Press.
- Lamontagne, G. (1989) "Suffix Triggered Variation in Southern Sierra Miwok," ms., University of Massachusetts, Amherst.
- Levin, J. (1983) "Reduplication and Prosodic Structure," ms., MIT.
- Levin, J. (1985) *A Metrical Theory of Syllabicity*, PhD Dissertation, MIT, Cambridge, MA
- Lombardi, L. and J. McCarthy (1990) "Prosodic Circumscription in Choctaw Morphology," ms., University of Massachusetts, Amherst.
- Lowenstamm, J. and J. Kaye, (1986) "Compensatory Lengthening in Tiberian Hebrew," in *Studies in Compensatory Lengthening*, (ed.) L. Wetzels and E. Seyer, 97-132, Foris Publications, Dordrecht.
- Marantz, A. (1982) "Re Reduplication," *Linguistic Inquiry* 13, 435-482.
- Marlett, S. and Stemberger, J. (1983) "Empty Consonants in Seri," *Linguistic Inquiry* 14, 617-639.
- McCarthy, J. (1979) *Formal Problems in Semitic Phonology and Morphology*, PhD Dissertation, MIT, Cambridge, MA Published 1985, by Garland Publishers, New York.

- McCarthy, J. (1981) "A Prosodic Theory of Nonconcatenative Morphology," *Linguistic Inquiry* 12-3.
- McCarthy, J. (1982) "Prosodic Templates, Morphemic Templates and the Morphemic Tier," in H. van der Hulst and N. Smith (eds.) *The Structure of Phonological Representations*, Foris Publications, Dordrecht, pp. 191-224.
- McCarthy, J. (1989) "Linear Order in Phonological Representation," *Linguistic Inquiry* 20.1, 71-99.
- McCarthy, J. and A. Prince (1986) "Prosodic Morphology," ms., University of Massachusetts, Amherst and Brandeis University, MA
- McCarthy, J. and A. Prince (1990) "Foot and Word in Prosodic Morphology: the Arabic Broken Plural," *Natural Language and Linguistic Theory* 8, 208-283.
- McCarthy, J. and A. Prince (to appear) "Prosodic Morphology and Templatic Morphology," in M. Eid and J. McCarthy (eds.) *Proceedings of the Second Annual Symposium on Arabic Linguistics*, John Benjamins, Amsterdam.
- McCarthy, J. and A. Prince (forthcoming) *Prosodic Morphology*, MIT Press, Cambridge, MA
- McCreight, K. (1985) "Topics in the Phonology of Southern Sierra Miwok," ms., MIT., Cambridge, MA
- Mohanar, K. P. (1982) *Lexical Phonology*, PhD Dissertation, MIT, Cambridge, Mass. Published under the title *The Theory of Lexical Phonology* (1986) D. Reidel, Dordrecht.
- Prince, A. (1983) "Relating to the Grid", *Linguistic Inquiry* 14, 19-100.
- Prince, A. (1985) "Improving Tree Theory", *Proceedings of BLS 11*, 471-490, University of California, Berkeley.
- Schein, B. and D. Steriade (1986) "On Geminates," *Linguistic Inquiry* 17, 691-744.
- Selkirk, E. (1980) "The Role of Prosodic Categories and English Word Stress," *Linguistic Inquiry* 11, 563-606.
- Selkirk, E. (1981) "Epenthesis and Degenerate Syllables in Cairene Arabic," in H. Borer and Y. Aoun (eds) *Theoretical Issues in the Grammar of Semitic Languages*, MIT Working Papers in Linguistics Vol. 3.
- Smith, N. (1985) "Spreading, Reduplication and the Default Option in Miwok Nonconcatenative Morphology," in H. van der Hulst and N.

- Smith (eds.) *Advances in Nonlinear Phonology*, Foris Publications, Dordrecht, pp. 363-80.
- Smith, N. and B. Hermans (1982) "Nonconcatenative woordvorming in het Sierra Miwok," *GLoT Jaargang* 5, 263-284.
- Steriade, D. (1982) *Greek Prosodies and the Nature of Syllabification*, PhD Dissertation, MIT, Cambridge, MA
- Steriade, D. (1987) "Redundant Values," in A. Bosch, B. Need and E. Schiller (eds.) *Papers from the 23rd Regional Meeting of the Chicago Linguistic Society, Part 2*, Chicago Linguistic Society, University of Chicago, Chicago, Illinois.
- van der Hulst, M. and N. Smith (eds.) (1982) *The Structure of Phonological Representations*, Foris Publications, Dordrecht.
- Wilkinson, K. (1988) "Prosodic Structure and Lardil Phonology," *Linguistic Inquiry* 19, 325-34.