Prosodic vs. Morphological Mora Augmentation

Stuart Davis and Isao Ueda

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1. Introduction

Mora augmentation occurs when, for reasons of prosody or morphology, a word or syllable is required to be lengthened. When mora augmentation occurs, the word (or syllable) is increased in length by one mora. Typologically, various means of mora augmentation are witnessed. These include vowel lengthening, consonant gemination, insertion into coda position, metathesis, and reduplication. In this paper we will offer the hypothesis that the preferred means of mora augmentation differ depending on whether augmentation occurs because of prosodic reasons or morphological reasons. If mora augmentation is required due to prosodic reasons then the preferred means of mora augmentation is by vocalic augmentation (typically vowel lengthening); but if augmentation is required because of the demands of the morphology, then consonantal augmentation is preferred (usually gemination or other consonantal insertion into coda position). As an example of morphological augmentation, consider the data in (1) from Shizuoka Japanese discussed at length by Davis and Ueda (2002).

(1) Adjective    Emphatic Form  Gloss
    a. hade      hande     sowy
    b. ozoiz     onzoiz    terrible
In (1) we see that the emphatic form of the adjective has an extra mora in the first syllable as compared to the plain adjective. In (1a-b) the additional mora is realized as a coda nasal; in (1c-d) it is realized as a geminate, and in (1e-f) it is realized through vowel lengthening. While there are different realizations of mora augmentation in (1), consonantal augmentation is preferred. Vocalic augmentation (by vowel lengthening) could occur in (1a-d) but does not; (1e) and (1f) show that vocalic augmentation can occur with the first syllable, but only when consonantal augmentation is impossible for phonotactic reasons. For example, in (1f) consonantal augmentation would result in the impossible [suppai] or [supppai]. Thus, (1) exemplifies the preference for consonantal mora augmentation when the augmentation is for morphological reasons.

In the following sections of this paper we will consider specific examples in detail offering optimality-theoretic analyses of the mora augmentation phenomena. In Section 2 we will consider prosodic mora augmentation in the Cariban language Kariña and in Section 3 we will examine morphological mora augmentation in the Salish language Saanich. Our analyses of these two languages will be couched in Optimality Theory (McCarthy and Prince 1992), especially in what has become known as Correspondence Theory, developed by McCarthy and Prince (1995). The constraints of Optimality Theory provide a way to express formally the different means that mora augmentation can be realized; the constraint rankings of Optimality Theory are a convenient tool to express the priority of different realizations of mora augmentation. In Section 4 of this paper we will discuss some issues raised by our proposal that prosodically induced mora augmentation favors vocalic augmentation whereas morphologically induced mora augmentation favors consonantal augmentation.

2. Prosodically-induced Mora Augmentation in Kariña

Kariña is a Native American language of the Cariban family spoken in Eastern Venezuela by some 10,000 people. The language has been described in works by Jorge Mosonyi and Jose Alvarez. Kariña has an iambic stress system very similar to its relative Hixkaryana (Derbyshire 1979), which has been discussed by Hayes (1995) and which we briefly address here. As Hayes observes, in Hixkaryana, stress falls on every second syllable in a string of light syllables (excluding the last) and on heavy syllables. In the theory of Hayes (1995) this can be captured by the placement of iambic feet starting from the beginning of the word. Data are given in (2). (The colon indicates vowel length and the period in the phonetic representation indicates a syllable boundary.)

(2) Underlying Form Phonetic Representation Gloss
a. /nemokotonō/ [ne.mo.ko.tō.no:] it fell
b. /aikmatari/ [a.gma.ta.ri] branch
c. /tohkurunonaxaha/ [tō.ku.ru.xonaxa.ha] finally to Tohkurye

The data in (2) reflect the phenomenon of iambic lengthening: the stressed syllable of an iambic pattern is made heavy (bimoraic) if it is not already heavy. In Hixkaryana this is done by means of vowel lengthening. Iambic lengthening can be understood as a type of prosodically induced mora augmentation phenomenon. In such a system, the requirement that stressed syllables be heavy induces mora augmentation of the stressed syllable (if it is not already bimoraic). We see that in Hixkaryana mora augmentation is by vowel lengthening and not by other means. Thus, in the prosodically induced mora augmentation of Hixkaryana, vocalic augmentation is preferred over consonantal augmentation differentiating it from the preferred consonantal augmentation of Shizuoka Japanese in (1). A hypothesis that emerges from this difference is that prosodically induced mora augmentation has a preference for vocalic augmentation while morphologically induced mora augmentation prefers consonantal augmentation. In this section, we will consider the rather intricate system of prosodically induced mora augmentation found in Kariña which witnesses three means of mora augmentation, namely vowel lengthening, gemination, and consonantal insertion in coda position. However, as will be shown, we will see that the preferred means of mora augmentation in Kariña is through vowel lengthening.

Let us first consider the Kariña data in (3). These data illustrate the iambic stress and lengthening pattern whereby stress falls on every second syllable in a string of light syllables (excluding the last) and on heavy syllables. As shown by the data in (3) the stressed syllable surfaces as bimoraic. In (3), the prosodically induced mora augmentation results in the lengthening of a vowel that is underlyingly short (i.e. monomoraic) so that the stressed syllable surfaces as bimoraic. In the transcription, the colon indicates vowel length. According to Alvarez (2000) if a word has more than one stress bearing syllable, the rightmost one receives primary stress. The location of the
A further complication of the Karīña mora augmentation pattern is that vowels cannot be lengthened before fricatives. Moreover, fricatives in Karīña, cannot be geminated. This means that when a vowel is in a stressed syllable and the following consonant is a fricative, mora augmentation cannot be realized by vowel lengthening or by gemination. In such a situation it is realized by the insertion of [h] into coda position of the stressed syllable so that syllable surfaces as bimoraic. This is illustrated by the data in (5). (S = voiceless alveopalatal fricative)

\[
\begin{array}{|c|c|c|}
\hline
\text{Underlying Forms} & \text{Phonetic Representations} & \text{Gloss} \\
\hline
a. /k-upi-So/ & [ku.pʰi.So] & \text{look for me} \\
b. /kiSiSui/ & [ki.Sʰi.Su.pi] & \text{don't wash him} \\
c. /kurusu/ & [ku.rʰu.su] & \text{cross} \\
d. /mθrisu/ & [mθ.rʰi.Su] & \text{palm tree (type)} \\
e. /s-eTa-seN/ & [se.tʰi.seN] & \text{I hear them} \\
f. /aroSi/ & [a.ro.Si] & \text{rice} \\
\hline
\end{array}
\]

An additional complication involves [h] which like other fricative, cannot be geminated. This means that if the syllable bearing stress has a vowel that is immediately followed by an [h] in the onset of the next syllable, then [h] cannot be inserted into the coda since that would create a geminate [h]. In such situations, the stressed syllable remains short (monomoraic) and mora augmentation fails to occur. This is illustrated by the penultimate syllables in the data items in (6).

\[
\begin{array}{|c|c|c|}
\hline
\text{Underlying Forms} & \text{Phonetic Representations} & \text{Gloss} \\
\hline
a. /an-emepa-ha/ & [a.nʰe.me.pʰa.ha] & \text{not teaching} \\
b. /maha/ & [mᵃ.ha] & \text{vegetable garden} \\
\hline
\end{array}
\]

Thus, in examining the data in (3)-(6), we witness three different types of mora augmentation as well as a specific instance illustrated by (6) where mora augmentation fails to occur. It should be clear from a comparison of the data that there is a preference for vowel lengthening as the means of mora augmentation. This is because in the data in (3), gemination or [h] insertion into the coda of the stressed syllable is phonotactically possible but does not occur; rather, vowel lengthening occurs. Given this, we now develop an optimality-theoretic analysis of mora augmentation in Karīña.
In developing an optimality theoretic analysis of mora augmentation in Kariña we must first consider the constraint motivating mora augmentation. The prosodic motivation can be seen by the constraint given in (7) that requires stressed syllables to be bimoraic. We leave aside the issue noted by Hayes (1995) that the constraint is more active in languages with iambic stress than those having trochaic stress since this is not crucial to our focus on how mora augmentation actually occurs.

(7) Stress-to-Weight -- Stressed syllables are bimoraic (cf. Kager 1999)

In Kariña this constraint outranks the one given in (8) which militates against the insertion of a mora.

(8) Dep-\(\mu\) -- Do not insert a mora.

As a result of the ranking of Stress-to-Weight over Dep-\(\mu\), a stressed syllable typically is realized as bimoraic. This is seen by the tableau in (9), where mora structure is indicated for clarity. (Also, in the tableaux, we indicate the winning candidate by the "plus" sign.)

(9) /m-a-\(\text{r-o-t-u/} -- [\text{ma-ro\(\text{t-u\)}} -- 'you carried them' (3a)

<table>
<thead>
<tr>
<th></th>
<th>Stress-to-Weight</th>
<th>Dep-(\mu)</th>
</tr>
</thead>
<tbody>
<tr>
<td>/maro(\text{tu/}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\mu\mu\mu)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. ma(\text{r-o-t-u/}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\mu\mu\mu)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+b. ma(\text{ro(t-u/}</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In the tableau in (9) we see that the ranking of Stress-to-Weight over Dep-\(\mu\) results in the winning candidate having an augmented mora in the stressed syllable. What the tableau does not show us is how the mora of the stressed syllable is augmented. In the data in (3), as reflected by (9), the augmented mora is realized through vowel lengthening. However, in (4) the augmented mora is realized through gemination and in (5) it is realized by means of [\(h\)]-insertion. Moreover, mora augmentation fails to occur with the syllables bearing primary stress in (6). We now turn to the analysis accounting for how mora augmentation is realized in Kariña.

The ranking of Stress-to-Weight over Dep-\(\mu\) in (9) motivates mora augmentation in the winning candidate, (9b), repeated below in (10a). However, given data like that in (4) and (5), mora augmentation could occur either by gemination or by \(h\)-insertion as shown by the candidates in (10b) and (10c), respectively.

(10) Output candidates for /m-a-\(\text{r-o-t-u/} -- 'you carried them'\)
    a. ma\(\text{r-o-t-u/} b. ma\(\text{r-o-t-u/} c. ma\(\text{r-o-t-u/}

The candidates in (10) each violate a constraint that results in mora augmentation. The candidate in (10a) violates the constraint in (11a); the candidate in (10b) violates (11b), and candidate (10c) violates (11c).

(11) Constraints resulting in mora augmentation
    a. *V: -- Long vowels are not permitted.
    b. *Gem -- Geminate consonants are not permitted.
    c. Dep-h -- [\(h\)] in the output corresponds to /\(h\)/ in the input. (Don't insert [\(h\)])

The three candidates in (10a-c) are each phonotactically possible in Kariña. The fact that the candidate in (10a) with a long vowel actually surfaces means that *V: is lower ranked than the other two constraints. This is shown by the tableau in (12) with the relevant ranking indicated in (13).

(12) /m-a-\(\text{r-o-t-u/} -- [\text{ma-ro\(t-u/} -- 'you carried them' (3a)

<table>
<thead>
<tr>
<th></th>
<th>Stress-to-Weight</th>
<th>Dep-(h)</th>
<th>*(\text{Gem/}</th>
<th>*(V/</th>
</tr>
</thead>
<tbody>
<tr>
<td>/maro(t-u/</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\mu\mu\mu)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. ma(ro(t-u/</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\mu\mu\mu)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. ma(ro(h-t-u/</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(\mu\mu\mu)</td>
<td></td>
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<tr>
<td>c. ma(ro(t-u/</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>(\mu\mu\mu)</td>
<td></td>
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<tr>
<td>+d. ma(ro(t-u/</td>
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</tr>
</tbody>
</table>
(13) Dep-h, *Gem \gg *V:

The tableau in (12) does not provide evidence for the relative ranking between Dep-h and *Gem. However, their ranking becomes apparent when we consider the data in (4). Recall that Kariña does not usually allow long high vowels. This is due to the high-ranking nature of the constraint in (14), based on Cole and Kisseberth (1995) and Archangeli and Suzuki (1997).

(14) *LongHV -- Long high vowels are not permitted.

This constraint would eliminate the candidate in (13a) with a long high vowel for the input form in (4a), /adu-ko/ ‘fry it’. The choice then would be between (15b) and (15c).

(15) Output candidates for ‘adu-ko/ ‘fry it’
   a. a.dû.ko   b. a.dû.ko   c. a.dû.ko

The fact that the candidate in (15b) with a geminate consonant actually surfaces means that *Gem is lower ranked than Dep-h. This is shown by the tableau in (16).

(16) /aduko/ -- [a.dû.ko] ‘fry it!’ (4a)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>*LongHV</th>
<th>Stress-to-Weight</th>
<th>Dep-h</th>
<th>*Gem</th>
<th>*V:</th>
</tr>
</thead>
<tbody>
<tr>
<td>/aduko/</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. a.dû.ko</td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. a.dû.ko</td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+c. a.dû.ko</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. a.dû.ko</td>
<td></td>
<td>V</td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The ranking of Dep-h over *Gem is shown in (17a) and the fuller ranking incorporating the ranking in (13) is shown in (17b).

(17) Ranking of the mora augmentation constraints
   a. Dep-h \gg *Gem (Tableau 16)
   b. Dep-h \gg *Gem \gg *V: (Tableau 16 and 12)

The data in (5), repeated below, reflect the two additional high-ranking constraints in (18), a constraint against geminate fricatives and a constraint disallowing the sequence of a long vowel followed by a fricative.

(5) Data illustrating the insertion of [h] into the coda of a stressed syllable

<table>
<thead>
<tr>
<th>Underlying Forms</th>
<th>Phonetic Representations</th>
<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. /k-upi-Su/</td>
<td>[ku.pi.Su]</td>
<td>look for me</td>
</tr>
<tr>
<td>b. /ki.Su Supi/</td>
<td>[ki.Su.pi]</td>
<td>don’t wash him</td>
</tr>
<tr>
<td>c. /kur.u/</td>
<td>[ku.ru]</td>
<td>cross</td>
</tr>
<tr>
<td>d. /mû.Ri Su/</td>
<td>[mû.ru.Su]</td>
<td>palm tree (type)</td>
</tr>
<tr>
<td>e. /s-e-ta-se/</td>
<td>[s.tâ.tâ.se]</td>
<td>I hear them</td>
</tr>
<tr>
<td>f. /aro Si/</td>
<td>[a.ro.Si]</td>
<td>rice</td>
</tr>
</tbody>
</table>

(18) Additional constraints
   a. *Gem.Fric -- Geminate fricatives are not permitted
   b. *V:Fric -- Long vowels cannot be followed by a fricative

The relevance of these constraints are shown by the tableaux in (19) and (20) for the forms in (5a) and (5f), respectively.
The constraint against geminate fricatives eliminates candidates (19c) and (20c) while the constraint against the sequence of a long vowel followed by a fricative crucially rules out candidate (20d). The fact that the winning candidates in (19) and (20) have the augmented mora realized by an inserted /h/ in the coda position of the stressed syllable provides evidence for the ranking in (21) with the combined ranking in (22).

(21) Stress-to-Weight >> Dep-h
(22) Stress-to-Weight >> Dep-h >> *Gem >> *V:

The ranking in (22) along with the ranking of Stress-to-Weight over Dep-µ from tableau (9) is able to account for the pattern of mora augmentation in Kariña witnessed by the data in (3)-(5). In tableaux (19) and (20) we have assumed that the constraints *LongHV, *GemFric, and *V:Fric outrank the Stress-to-Weight constraint. While we do not present evidence that *LongHV outranks Stress-to-Weight, the data in (6) in which mora augmentation is prevented provide evidence that *GemFric, and *V:Fric outrank Stress-to-Weight. This is shown by the tableau in (23), where we show the evaluation of the word in (6c).

The tableau in (23) raises several issues. First, as mentioned, it does not provide a clear ranking argument for the ranking of *LongHV over Stress-to-Weight. The other data in (6) also do not crucially show the ranking of *LongHV with respect to Stress-to-Weight. What is clear is that *LongHV must be higher ranked than *Gem or else the output forms in (4) would surface with a long high vowel rather than with a geminate consonant. A second issue emerging from the tableau in (23) is distinguishing two candidates that can be transcribed as [má:ha], one where the /h/ is a geminate (i.e. a single root node that is moraic with one set of features) and one where there is a sequence of two identical root nodes each having the same set of features. Neither of these candidates surface. While the former violates *GemFric, the latter would violate the OCP. A third issue that emerges from the tableau in (23) is a consideration of the candidate [má:ha] which satisfies Stress-to-Weight by the insertion of a nasal consonant. This candidate could be phonotactically possible in Kariña. However, the fact that such a candidate does not surface suggests that a constraint like Dep-Nasal (which militates against the insertion of a nasal) outranks Stress-to-Weight.

The overall constraint ranking that accounts for the realization of mora augmentation in Kariña is shown in (24) along with the additional rankings shown in (25) and (26).

(25) *LongHV >> *Gem (Tableau 16)
(26) Stress-to-Weight >> Dep-µ (Tableau 9)

These rankings show that, all else being equal, the preferred means of mora augmentation is by vowel lengthening. This is seen by the data in (3) as reflected by the tableau in (9) where candidates with vowel lengthening,
gemination, and h-insertion are all phonotactically possible. That such data 
surface with vowel lengthening demonstrates that vowel lengthening is the 
preferred means of mora augmentation. This supports the hypothesis that 
prosodically induced mora augmentation favors vocalic augmentation. In the 
next section we will consider an interesting case of morphologically induced 
mora augmentation from Saanich.

3. Morphologically-induced Mora Augmentation in 
Saanich Salish

In the preceding section we offered a detailed optimality-theoretic analysis of 
the prosodically-induced mora augmentation in Kariña. We saw that in Kariña 
there was a preference for vocalic mora augmentation. This distinguished 
Kariña from the example of morphologically-induced mora augmentation 
from Shizuoka Japanese in (1) that displayed a preference for consonantal 
mora augmentation. In this section we will consider another instance of 
morphologically-induced mora augmentation in more detail. Here, we will 
consider the formation of the actual aspect in Saanich, an Interior Salish 
language of British Columbia. This case of mora augmentation is quite 
different from Kariña as well as Shizuoka Japanese because Saanich is a 
language that lacks long vowels and geminate consonants. Nonetheless, mora 
augmentation does occur in the formation of the actual aspect, and, as we will 
show, the morphological augmentation process prescribes consonantal 
augmentation to vocalic augmentation.

Let us consider the actual aspect data in (27) where the Saanich actual 
form is based on its non-actual counterpart. (The Saanich actual aspect is 
discussed by Montler (1986) and Stonham (1994) from whom the data are 
taken. A different view of the data is presented by Kurisu (2001), who gives 
an analysis in terms of morpheme realization, an analysis that is not incompatible 
with the mora augmentation analysis that we present below, though we do not 
elaborate on the similarity and differences) (Note the following transcription 
symbols: ? = glottal stop, E = schwa, L = voiceless lateral fricative, N=velar 
nasal)

(27) Mora augmentation in the actual aspect of Saanich

<table>
<thead>
<tr>
<th>Non-actual</th>
<th>Actual</th>
<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. se</td>
<td>seʔ</td>
<td>send</td>
</tr>
<tr>
<td>b. ne</td>
<td>neʔ</td>
<td>name something</td>
</tr>
<tr>
<td>c. wE.qEs</td>
<td>wEʔ. qEs</td>
<td>yawn</td>
</tr>
</tbody>
</table>

d. ?i.ŁEn'  | ?i.ŁEn'  | eat       |
| e. t'sE    | t'Es    | breaking something |
| f. tk'WE   | tEk'W   | breaking (stick) |
| g. tq'WE   | tEq'W   | tightening something |
| h. q'k'WE  | q'Ek'W  | straightening something |
| i. qen'    | q̟εn'   | stealing something |
| j. q'WEl'  | q̟εl.q'WEl' | saying something |
| k. Lap'    | La.lap' | eating (soup) |
| l. Lik'W.sEn | l̟i.lEk'W.sEn' | tripping |

In (27) we observe that the actual aspect is formed based on the non-
actual counterpart in one of three ways. In (27a-d), the actual aspect is formed 
by the insertion of a glottal stop in coda position of the first syllable. In 
(27e-h), the actual aspect is formed by CV metathesis. And in (27i-l) the 
actual aspect is formed by reduplication of the first CV sequence though it is 
ambiguous as to whether the reduplication is prefixal or infixal; in either case 
the second vowel of the reduplicated form is typically reduced.

A question that immediately arises regarding the data in (27) is whether 
the three processes shown in (27), namely glottal insertion, metathesis, and CV 
reduplication are unrelated or can be understood in a unified way. Here we 
follow Stonham (1994), who maintains that what unifies the disparate 
processes in (27) is that they each add a single mora to the non-actual form. 
That is, the actual aspect is formed by mora augmentation. Specifically, in 
(27a-d) the insertion of glottal stop into coda position adds a mora. In (27e-h) 
metathesis adds a mora since after metathesis there is a coda consonant. And 
in (27i-l), CV reduplication adds one mora. Following up on Stonham’s 
work, we posit that the actual aspect is represented by a floating mora. Since 
the actual aspect derives from the corresponding non-actual form, the actual 
is in an output-output relation with the non-actual form with the prosodified non-
actual serving as the base of the actual form. This is exemplified by the 
representation in (28) for the word in (27c), where μ indicates the actual 
morpheme.

(28) Representation of the actual form (27c)

\[
\begin{align*}
\mu_e & \rightarrow \mu \\
\mu & \rightarrow \\
\text{wE.qEs} & \rightarrow \text{wE.qEs}
\end{align*}
\]

Given the representation in (28) we now will develop an optimality-theoretic 
analysis of the data in (27), first discussing the relevant constraints and their
means of mora augmentation in (27) and how that reflects the ranking among dominated constraints. In examining the data in (27), we observe that there are three different means of mora augmentation that are not witnessed in either Hixkaryana or Shizuoka Japanese. In (27a-d) mora augmentation occurs by insertion of a glottal stop in coda position. These forms would violate a constraint against the insertion of glottal stops given in (31a). In (27e-h), mora augmentation occurs by the metathesis of a CV sequence by which a consonant in onset position surfaces in the coda thus adding a mora to the actual output. These forms violate a constraint on linearity (Hume 1998, Kager 1999) given in (31b) which requires the precedence structure of two strings in correspondence to be maintained. In (27i-l), mora augmentation seems to occur by reduplication. However, we maintain that the actual aspect in (27i-l) is not formally reduplication (with a triggering RED morpheme) but simply CV insertion. This violates the constraint Dep-CV given in (31c). In (27i-l) the inserted vowel adds an extra mora and so reflects vocalic mora augmentation as opposed to the consonantal mora augmentation that is found with glottal insertion or metathesis where the augmented mora is a consonantal mora in coda position. A consonant must be inserted in (27i-l) so as to avoid a violation of the undominated Onset constraint.

(31) Dominated constraints reflecting mora augmentation
   a. Dep-? -- Don’t insert a glottal stop.
   b. Linearity -- Precedence structure of two strings in correspondence is maintained
   c. Dep-CV -- Do not add a CV sequence to the output

With respect to the ranking of the three constraints in (31), the most revealing data are those showing metathesis in (27e-h). This is because hypothetically in (27e-h), mora augmentation could occur either by glottal insertion, CV insertion, or metathesis without violating any of the undominated constraints. The fact that metathesis occurs rather than glottal insertion or CV insertion argues that Linearity is lower ranked than either Dep-? or Dep-CV as shown in (32). This implies that metathesis is the preferred means of mora augmentation in Saanich.

(32) Dep-CV, Dep-? >> Linearity

However, metathesis does not occur in (27a-d). This is because its occurrence would result in a violation of high ranking Onset. Since there is an onset cluster in the non-actual forms in (27e-h), metathesis can occur in the
formation of the actual without violating Onset. Although metathesis cannot occur in (27a-d) both CV-insertion and ?-insertion into the coda should be theoretically possible in (27a-d) without violating undominated constraints. The fact that ?-insertion occurs rather than CV-insertion argues for the ranking of Dep-CV over Dep-? as shown in (33) with the full ranking in (34).

(33)  Dep-CV >> Dep-?
(34)  Dep-CV >> Dep-? >> Linearity

Notice that in (27i-l) neither ?-insertion nor metathesis can occur since ?-insertion would result in a trimoraic initial syllable and metathesis would result in an onsetsless initial syllable. CV insertion occurs as a means of mora augmentation only when the first syllable of the base is heavy. In (35)-(37) we present the tableaux that evaluates the different means of mora augmentation reflected by the data in (27).

(35) / μₐ + t'sE/ → [t'sEs]  'breaking something' (27c)

<table>
<thead>
<tr>
<th>μₐ</th>
<th>t's E</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Gem</td>
<td>Onset</td>
</tr>
<tr>
<td>μₐ</td>
<td>*V:</td>
</tr>
<tr>
<td>a. t'sE s E</td>
<td>[t'sEsE]</td>
</tr>
<tr>
<td>+b. t' E s</td>
<td>[t'sEs]</td>
</tr>
<tr>
<td>μₐ</td>
<td>t's E ?</td>
</tr>
<tr>
<td>c. t's E ?</td>
<td>[t'sE?]</td>
</tr>
<tr>
<td>μₐ</td>
<td>![t'sE]</td>
</tr>
<tr>
<td>d. t's E E</td>
<td>[t'sEs]</td>
</tr>
</tbody>
</table>

(36) / μₐ + ne/ → [ne?]  'name something' (27b)

<table>
<thead>
<tr>
<th>μₐ</th>
<th>ne</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Gem</td>
<td>Onset</td>
</tr>
<tr>
<td>μₐ</td>
<td>V:</td>
</tr>
<tr>
<td>a. n e</td>
<td>[nee]</td>
</tr>
<tr>
<td>b. n e</td>
<td>[nee]</td>
</tr>
<tr>
<td>c. n e n e</td>
<td>[nee]</td>
</tr>
<tr>
<td>μₐ</td>
<td>n</td>
</tr>
<tr>
<td>d. e n</td>
<td>[en]</td>
</tr>
<tr>
<td>μₐ</td>
<td>![en]</td>
</tr>
<tr>
<td>e. n e ?</td>
<td>![ne?]</td>
</tr>
</tbody>
</table>

(37) / μₐ + qen/ → [qēEn']  'stealing something' (27i)

<table>
<thead>
<tr>
<th>μₐ</th>
<th>q e n'</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Gem</td>
<td>Onset</td>
</tr>
<tr>
<td>μₐ</td>
<td>V:</td>
</tr>
<tr>
<td>a. q e q e n'</td>
<td>[qēEn']</td>
</tr>
<tr>
<td>+b. q e n'</td>
<td>[qēn']</td>
</tr>
<tr>
<td>μₐ</td>
<td>![qēn']</td>
</tr>
<tr>
<td>c. q e n ?</td>
<td>![nq]</td>
</tr>
<tr>
<td>μₐ</td>
<td>![nq]</td>
</tr>
<tr>
<td>d. q e n ?</td>
<td>![nq]</td>
</tr>
</tbody>
</table>
The case of Saanich is interesting in that mora augmentation occurs even though the language does not have geminates or long vowels. The analysis of the Saanich data in (27) given here shows the preferred way for mora augmentation is metaphase, then -insertion, then reduplication. That is, in Saanich the preferred means for the morphological mora augmentation is by the addition of a consonantal mora. This is contrasted with the prosodically induced mora augmentation in Karíña discussed in Section 2 where the preferred means of mora augmentation was by the addition of a vocalic mora.

4. Discussion and Conclusion

In comparing the morphological mora augmentation in Saanich with that briefly mentioned in (1) for Shizuoka Japanese we note that in both cases of morphologically induced mora augmentation there is a preference for consonantal mora augmentation rather than vocalic augmentation even though the particular means of mora augmentation is strikingly different in the two languages. In both languages the preferred way of mora augmentation is by adding a consonantal element into the syllable coda position. This could be by gemination or nasal insertion as in Shizuoka Japanese or by means of glottal insertion or metaphase of a consonant into coda position as in Saanich. In both languages mora augmentation occurs because of the requirements of the morphology.

While consonantal augmentation seems to be preferred in morphologically induced cases like Saanich and Shizuoka Japanese, vocalic augmentation by vowel lengthening is a common means of mora augmentation when augmentation is required by the system of prosody such as in languages like Karíña and Hixkaryana. We do not think this is an accident. Other cases of prosodically induced augmentation that we are aware of also give priority to vocalic augmentation. In addition to Karíña, this would include the iambic lengthening of Hixkaryana shown in (1), diphthongization of stressed tense vowels in modern English, and vowel lengthening in Kansu Japanese where a binominal minimal word is strictly enforced (e.g. /te/ ‘hand’ surfaces as [tee]). With respect to morphologically induced mora augmentation, Davis and Ueda (2001) discuss the case of the formation of the imperfective in the Muskoegean language Alabama (Hardy and Montler 1988) where the imperfective is marked by an extra mora with the perfective form as the base. If phonotactically possible, the extra mora is realized as insertion into coda position of the antepenultimate syllable; this could be by gemination as in [hocoba] - [hoccoba] ‘big’ or it could be by nasal insertion if the consonant is one that does not normally geminate in the language as seen in [taba] - [tabatka] ‘grab’. If insertion into the coda is not phonotactically possible, then mora augmentation is realized by vowel lengthening as in [hokn] - [hoohn] ‘smell’. The Alabama imperfective then clearly shows a preference for consonantal mora augmentation.

The question that emerges is why, when augmentation is required because of the morphology, consonant augmentation is the preferred means whereas when it is required for prosodic reasons vocalic augmentation is preferred. We speculate that here may be a functional reason for this in that, if one considers the realization of stress, we note that pitch is one of the main correlates of stress. Since vowels are the best bearers of pitch, it follows that augmentation due to stress should prefer vowel lengthening over other means. On the other hand, one could speculate that augmentation due to morphology should interact as little as possible with prosody and that such is easier to achieve by consonantal augmentation as opposed to vocalic augmentation. An observation that is perhaps not unrelated to this difference is that in the case of prosodically induced mora augmentation, as in Karíña, all stress syllables in the word are targeted for mora augmentation, whereas in morphologically induced mora augmentation only one syllable in the word undergoes augmentation.

There are certain implications that arise from our hypothesis regarding the difference between prosodically induced and morphologically induced mora augmentation. First, we do not want to claim that vowel length can never be used morphologically as the primary indicator of a certain class of words. Such cases do occur. One example of this is the Classical Arabic verbs of the 3rd form which frequently marks the reciprocal. Consider the data in (38).

(38) Classical Arabic Form 3 (reciprocal) Verbs
   a. [kataba] ‘write’  [katataba] ‘correspond with’
   b. [qaba] ‘meet’  [qaabala] ‘meet one another’

Here we see that morphologically the reciprocal is marked by the lengthening of the first vowel. Our analysis of this would involve the presence in the input of a morphological mora that would be left aligned in the sense that it has to be realized in the initial syllable. However, because the mora augmentation is always realized as a vocalic mora, we would posit that the input mora indicating Form 3 would be subscripted as a vocalic mora. Thus, the representation of the Form 3 verb would be as in (39).
Representation of a Form 3 (reciprocal) verb
\[ \mu_1 \mu_1 \mu_1 \mu_1 \mu \]
\[ k a t a b a \quad \text{output = [kaataba] 'correspond with'} \]

The initial vocalic mora that marks the Form 3 verb class would be realized as lengthening on the first vowel by the constraint ranking. Thus, when vowel length is used morphologically, we would analyze it as involving a floating mora marked as being vocalic. (The cases of vocalic mora augmentation discussed by Alvarez 2005 almost all involve the lengthening of a word-final vowel and could be viewed as a prosodic requirement on the final syllable, that it be bimoraic.)

A second issue that arises from our hypothesis is that there should be examples where both prosodically induced mora augmentation and morphologically induced mora augmentation occur in the same language. A good example of this is the Native American language Chocaw. As discussed by Lombardi and McCarthy (1991) this language has both prosodically induced iambic lengthening and morphological consonant gemination. In the system of iambic lengthening, every underlying monomoraic vowel that surfaces in a stressed open syllable is lengthened so as to meet the requirement that a stressed syllable should be bimoraic. Morphologically induced mora augmentation occurs on the completive form of the verb. While the specifics are quite complicated, the data in (40) show the preference for consonantal augmentation in the completive.

The Choctaw Completive

<table>
<thead>
<tr>
<th>Base</th>
<th>Completive</th>
<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. talakCi</td>
<td>tallakCi</td>
<td>to be tied</td>
</tr>
<tr>
<td>b. kobaffi</td>
<td>kobaffi</td>
<td>to break</td>
</tr>
</tbody>
</table>

The analysis would involve a floating mora that marks the completive aspect. The constraint ranking would result in the preference for an output with gemination as opposed to vowel lengthening. An intriguing issue that we do not pursue here is how the constraint ranking system would make sure that iambic lengthening results in a lengthened vowel, but completive morphology results in a preference for consonantal gemination.

To conclude, in this paper we have offered the hypothesis that when mora augmentation is required because of the morphology consonantal augmentation is preferred but when it is brought about due to prosodic reasons then vocalic augmentation is preferred. We have suggested that there may be functional reasons for this difference. We expect future research to have a bearing on this issue.

References


dissertation, University of California, Santa Cruz.
Lombardi, Linda and John McCarthy (1991) Prosodic circumscription in
McCarthy, John and Alan Prince (1953) Generalized alignment. In G. E. Booij
Dordecht: Kluwer.
In Jill Beckman, Laura Walsh Dickey, and Suzanne Urbanczyk (eds.)
*University of Massachusetts Occasional Papers 18: Papers in
Montler, Timothy (1986) An outline of the morphology and phonology of
Saanich, North Straits Salish. *Occasional Papers in Linguistics 4*,
University of Montana.
Stonham, John (1994) *Combinatorial Morphology*. Amsterdam: John
Benjamins.

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(Davis, Stuart) Indiana University
(Ueda, Isao) Osaka University of Foreign Studies

Abstract

**Prosodic vs. Morphological Mora Augmentation**

Stuart Davis and Isao Ueda

Mora augmentation occurs when, for reasons of prosody or morphology, a
word or syllable is required to be lengthened. When mora augmentation
occurs, the word (or syllable) is increased in length by one mora.
Typologically, various means of mora augmentation are witnessed. These
include vowel lengthening, consonant gemination, insertion into coda position,
metathesis, and reduplication. The hypothesis that will be supported in this
paper is that the means of mora augmentation differ depending on whether
augmentation occurs because of reasons of prosody or morphology.
Specifically, if mora augmentation is required due to prosodic reasons then
vocalic mora augmentation is preferred whereas if it is required due to
morphological reasons then consonantal mora augmentation is preferred. We
examine two cases of mora augmentation in detail: prosodic mora
augmentation in the Cariban language Kariña and morphological mora
augmentation in Saanich Salish. We conclude by discussing various issues that
arise from our presentation.