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Winnebago Word Prosody and Focused Delimiter Insertion*

John Frampton

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I take as a starting point the analysis of Winnebago in Halle and Idsardi (1995, p. 430–39), with the analysis of Hayes (1995, p. 346–65) providing important background. In earlier versions of this paper, a general theory was developed before the Winnebago data was analyzed in terms of that theory. Here, I take a different approach and develop the theory as the various phenomena of Winnebago word stress are encountered.

The data is from Susman (1943), Miner (1979, 1981, 1989), Hale and White Eagle (1980), and Halle (1990). Since there is some inconsistency in the data, it is important to know the source of examples. The examples below will refer to pages in S43, M79, M81, M89, HWE, and H90.

Section 1. Winnebago words which have only light syllables

We first consider some examples with light syllables. The grouping into feet in the second column is conjectural at this point. But I take it as the default that feet are binary, which forces this footing and iambic stress.

(1)	a. *hi.žą́*	(× ×́)	‘dress’	HWE:130
	b. *ho.ta.xí*	× (× ×́)	‘expose to smoke’	M79:28
	c. *ho.čį.čį́.nįk*	× (× ×́) ×	‘the taste’	M79:28
	d. *ho.ki.wá.ro.kè*	× (× ×́)(× ×́)	‘swing (n.)’	M79:28
	e. *ha.ki.rú.ǰik.gà.ǰą*[1]	× (× ×́)(× ×́) ×	‘after he pulls taught’	M89:152

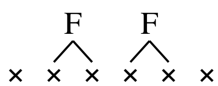
I will call the ×-marks beats. As we go forward we will discover exactly what they are. There is a full discussion in Section 4.2. In Winnebago they are the metrical personas of moras. Syllables with a short nucleus are metrically monomoraic in Winnebago.

* Thanks to Morris Halle for raising in my mind the objections and criticisms that I think he would have made. They made this paper better. Thanks also to Sam Gutmann for many years discussing the most fruitful way to approach explanatory adequacy in linguistic theorizing.

1. Winnebago also has words which require a ternary analysis. For example, *ho.ki.wá.ro.ro.ké* ‘swing (v.intr.)’, M81:342. I will avoid these words until Section 4 where ternary stress will be discussed.

There is agreement in the sources that primary stress is on the stressed beat of the initial foot, but disagreement about whether the subsequent stress is truly secondary. See Hayes (1995, p. 349) for a careful discussion. Since my concern is footing, I often use an acute mark to indicate all foot-level stress in metrical representations, main or secondary.

Up until Idsardi (1992), the foot structure of (1e), for example, was taken to be (2). (1e) was a typographical shortcut. The parentheses that appear above in (1e) were regarded as diacritics signaling the boundaries of *foot objects*.

(2) 

In Idsardi's theory, foot delimiters are not diacritics associated with a foot, but actual *beat line objects*. The beat line is a sequence of beats and delimiters.

(3) $\times\langle\times\ \ \times\rangle\times\ \ \times\rangle\times$

Delimiters do not have to match. Each delimiter is one-sided. Importantly, there is no ambiguity at all about which groups the delimiters in (3) determine. Just as there are none in how beats are grouped in (4).

(4) $\times\ \ \times\rangle\times\langle\times\ \ \times$

A *foot* is a subsequence f of the beat line consisting of beats, one edge of which is in the context $/\ \_\_\rangle$ or the context $/\ \langle\_\_$, and the other edge is not adjacent to a beat outside of f.

Idsardi (1992, p. 3) introduced the idea of a 'marking rule'; a non-iterative rule which located a foot boundary by reference to a feature of the initial representation, a word edge or the edge of a heavy syllable, H&I analyzed the rule system which generates (3a–d) as the marking rule (5.1) followed by the iterative rule (5.2).

(5) a. Insert a left foot delimiter to the right of the leftmost beat.

b. Iteratively, from left to right, insert a right delimiter to the right of every pair of beats.

The marking rule, (5.1), is focused on a particular beat, the leftmost beat. The iterative rule, (5.2), is not so clearly focused since 'pair of elements' is not an object in the phonology, certainly not before delimiter insertion has gathered them into a foot. Essentially, the target is a foot in waiting.

Instead of (5), the footing can be carried out by rules focused on beats. Rule names are given at the right to facilitate discussion. Rule names in this paper are always GB or GF with perhaps a subscript to give information about where the rule applies. GB rules always (G)roup beats (B)ack towards the edge at which iteration starts. GF rules always (G)roup beats (F)orward away from the starting edge.

(6)
$$\left.\begin{array}{l} \times \ \rightarrow \ \times\langle \ / \ \#\_\_ \\ \big[\times \ \rightarrow \ \times\rangle \big]_{\mathrm{LR}} \end{array}\right\} ; \ {}^{*}\textsc{Uny} \qquad \begin{array}{l} (\mathrm{GF}_{\#}) \\ (\mathrm{GB}) \end{array}$$

$[\ \ ]_{\mathrm{LR}}$ is taken to mean directional iteration in the direction indicated by the subscript. The semicolon introduces a derivational constraint. The constraint *Uny disallows beats which are in feet that contain no other beats, so-called unary feet.

It is tedious to give step-by-step derivations, so what I call *derivation summaries* will usually be given. (7) has derivation summaries of the (1) examples. They are highly annotated versions of the metrical representations. Delimiters inserted by marking rules are doubled. A pointer and rule name is under each beat to which a DIR has applied. Of course, the pointer points to the delimiter which was inserted. The annotations give information about the history of the derivation. It is for the reader. The grammar makes no use of the annotations.

(7) a. *hi.žą́*
$$\times \quad \underset{\substack{> \\ \mathrm{GB}}}{\times}\rangle$$

b. *ho.ta.xí*
$$\underset{\substack{> \\ \mathrm{GF^x}}}{\times}\langle\!\langle \times \quad \underset{\substack{> \\ \mathrm{GB}}}{\times}\rangle$$

c. *ho.čį.čį́.nįk*
$$\underset{\substack{> \\ \mathrm{GF^x}}}{\times}\langle\!\langle \times \quad \underset{\substack{> \\ \mathrm{GB}}}{\times}\rangle \times$$

d. *ho.ki.wá.ro.ké*
$$\underset{\substack{> \\ \mathrm{GF^x}}}{\times}\langle\!\langle \times \quad \underset{\substack{> \\ \mathrm{GB}}}{\times}\rangle \times \quad \underset{\substack{> \\ \mathrm{GB}}}{\times}\rangle$$

e. *ha.ki.rú.ǰik.gà.ǰą*
$$\underset{\substack{> \\ \mathrm{GF^x}}}{\times}\langle\!\langle \times \quad \underset{\substack{> \\ \mathrm{GB}}}{\times}\rangle \times \quad \underset{\substack{> \\ \mathrm{GB}}}{\times}\rangle \times$$

The reader should verify that none of the rules could have applied to the beats which do not have an annotation under them because such application would have violated *Uny.

The change from (5) to (6), from H&I's conception of a delimiter insertion rule system to focused delimiter insertion seems almost trivial, a terminological or purely formal matter. But it has major consequences. In simple systems, nothing particularly noteworthy is gained by this view of delimiter insertion. But in more complex systems, there are several important advantages to be gained by restricting DIRs to focused DIRs.

(8) 1. It gives a natural way to adapt Prince's (1985) Free Element Condition (FEC) to footing by delimiter insertion. The adaptation is called the Free Beat Condition (FBC). It will be taken up in the next section.

2. It allows multiple DIRs to combine in a rule scheme and vie for application at a given beat. Winnebago has a ternary variation and iterative rules schemes will allow for analysis of the variation as the optional deletion of one subrule of the iterative rule scheme. This will be taken up in Section (4).

3. It gives a framework for imposing natural locality conditions on delimiter insertion rules which have the effect of limiting rhythmic stress to either binary or ternary (gapped binary) stress, without compromising empirical adequacy. See Frampton (2023) for the proof (p. 14) and more generally for the discussion of locality.

Section 2. Bimoraic syllables and the Free Beat Condition (FBC)

We start with a few examples. The footing is conjectural at this point.

(9) Words with non-initial metrically bimoraic syllables

a.	*ha.ǰaːk*	× (×‿×́)	'he (moving) saw'	S43:10
b.	*ki.ríː.ną*	× (×‿×́) ×	'returned'	H90:149
c.	*ha.ra.gí.ną́į.če*	× (× ×́)(×‿×́) ×	'you will suffer it'	S49:139

(9b) and (9c) indicate that at least CVV syllables must be associated with 2 beats. The examples in (12) will show that CVC syllables are associated with only 1 beat. The tentative conclusion is that beats are associated with moras, but that consonantal moras do not project a metrical beat. Some moras are metrical, others are not. The cosyllabic moras, those projected from cosyllabic moras, are indicated below as joined by a ‿ mark. The mark is a diacritic indicating properties of the two moras, not a beat line object. The properties give cosyllabicity information.

We add another marking rule to (6).

(10)

$$\left.\begin{array}{l} \times \;\rightarrow\; \times\langle \;/\; \_\_\smile\times \\ \times \;\rightarrow\; \times\langle \;/\; \#\_\_ \\ \big[\, \times \;\rightarrow\; \times\rangle \,\big]_{LR} \end{array}\right\} ;\ {*}\text{U}\textsc{ny} \qquad \begin{array}{l} (GF_H) \\ (GF_\#) \\ (GB) \end{array}$$

GF_H is so named because syllables whose metrical representation in ×‿× are usually identified as heavy syllables.

This correctly predicts (9a,b,c).

(11)

a. *ha.ǰáːk*
× ⟪ ×‿×́ ⟩
GF$_\#$ GB

b. *ki.ríː.ną*
× ⟪ ×‿× ⟩ ×
GF$_\#$ GB

c. *ha.ra.gí.ną́į.če*
× ⟨ × ×́ ⟪ ×‿×́ ⟩
GF$_\#$ GF$_H$ GB

I assume that stress assigned to a metrical mora surfaces on the syllable which contains the mora.

There is an explanation for why the stress system includes this marking rule. Prince (1976) proposed that there is Syllable Integrity; syllables are not split between feet. Section 4.1 takes issue with this, but does agree that it is a marked phenomenon and that word-stress systems generally inserts in such a way that syllables are not split. In Winnebago, GF_H places a ⟨-delimiter to the left of every non-initial ×‿×. Coupled with the *Uɴʏ constraint, this guarantees that at least non initial bimoraic syllables are not split by a foot delimiter. Chugach uses a variant, × → ⟨× / __‿, which inserts a ⟨-delimiter to the left of every ×‿× pair. This guaranties that no bimoraic syllables will be split by a foot delimiter,

The next examples have pairs of unfooted beats.

(12) More words with non-initial metrically bimoraic syllables

a.	*hit.ʔat.ʔá:k*	× ×(×‿×́)	‘he (moving) talked’	S43:10
b.	*hit.ʔet.ʔéi.re*	× ×(×‿×́)×	‘they speak’	S43:10
c.	*hi.žą.kí:.čąš.gu.nį́ą́.ną.gá*	× ×(×‿×́)× ×(×‿×́)(× ×́)	‘nine and’	M79:25
d.	*nįk.šik.ší.nįk.ǰą.né:.ną*	×(× ×́)× ×(×‿×́)×	‘it will not be weak for you’	S43:41

It is important that GF_H is ordered before $GF_\#$, otherwise $GF_\#$ would apply in (12a,b,c). Instead, GF_H applies and blocks $GF_\#$ because of *Uny violation would result if it did apply.

There is no account at this point of why GB does not apply to the second beat in the 2 beat sequences of unfooted beats in (12). We have no reason at this point to rule out (13), for example, which incorrectly predicts *hit.ʔát.ʔá:k* for (12a).

(13) × × ×‿× → × ×《×‿× → × ×〉《×‿× → × ×́〉《×‿×́〉
GF_H ... GF_H, GB ... GF_H, GB, GB

H&I rule this out by imposing a derivational constraint *〉〈. But there is a deeper and more explanatory reason, which we take up in the next section.

2.1 The Free Beat Condition (FBC).

Prince’s (1985) Free Element Condition blocks beats that have already been footed from inclusion in a new foot. This is stronger than simply blocking beats from being in two different feet. A footed beat cannot become a beat of a different foot. This does not hold in Idsardi’s theory of footing. 〈× × × ×〈× × → 〈× ×〉× ×〈× × is perfectly acceptable. What does appear to be true is (14).

(14) Free Beat Condition (FBC): Only beats to which a footing rule has not applied are free to be the target of another footing rule.

Beats which are not free will be called *inactive*.

The FBC makes it clear why the derivation (13) is not valid. Both GF_H and GB have applied to the same beat.

The derivation summaries of the (9) examples follow.

(15)

a. *ha.ǰa:k*
×《×‿×́〉
$GF_\#$ GB

b. *hit.ʔat.ʔá:k*
× ×《×‿×́〉
GF_H GB

c. *hit.ʔet.ʔéi.re*
× ×《×‿×́〉×
GF_H GB

d. *hi.žą.kí:.čąš.gu.nį́ą́.ną.gá*
× ×《×‿×́〉× ×《×‿×́〉× ×́〉
GF_H GB GF_H GB GB

e. *nįk.šík.ši.nįk.ǰą.né:.ną*
×〈× ×́〉× ×《×‿×́〉×
$GF_\#$ GB GF_H GB

Note that (11c) shows that there is no prohibition against (× ×́)(×‿×́). The appearance of two unfooted beats to the left of bimoraic beat couplets is not the consequence of stress clash avoidance.

There is a plausible account in Section 4.1 of how the Winnebago stress system may have evolved the × → ×⟨ rule as a way to mark the left word edge and the left edges of bimoraic beat couplets.

2.2 Initial heavy syllables

GF_H does not mark initial cosyllabic beat couplets since there is no beat on its left. We therefore expect that initial cosyllabic pairs might behave differently than non-initial cosyllabic pairs.

First, some examples, with plausible foot groupings conjectured on the basis of binary feet and iambic stress.

(16)	a. *hoː.čą́k*	×‿(× ×́)	‘Winnebago’	M79:27
	b. *hoː.cą́g.ra*	×‿(× ×́) ×	‘the Winnebago’	M79:27
	c. *naː.wáːk*	×‿× (×‿×́)	‘he (moving) was singing’	S43:10
	d. *wai.pé.res.gá*	×‿(× ×)(× ×)	‘linen’	M79:18
	e. *mąː.cái.re*	×‿× (×‿×́) ×	‘they cut a piece off’	M79:29

All these examples are predicted by (10). The word-initial cosyllabic beat couplet acts as it were a sequence of 2 monosyllabic beats. The derivations are below.

(17) a. *hoː.čą́k*
× ⟪ × ×́ ⟩
$GF_\#$ GB

b. *hoː.cą́g.ra*
× ⟪ × ×́ ⟩ ×
$GF_\#$ GB

c. *naː.wáːk*
×‿× ⟪ ×‿×́ ⟩ †
GF_H GB

d. *wai.pé.res.gá*
× ⟪ × ×́ ⟩ × × ⟩
$GF_\#$ GB GB

e. *mąː.cái.re*
×‿× ⟪ ×‿×́ ⟩ × †
GF_H GB

† GF_H is ordered before the iterative rule, so $GF_\#$ is blocked by *Uny.

If Syllable Integrity were inviolable, $GF_\#$ would be blocked, but it is not. I will return in Section 4.1 to justify this violation of Syllable Integrity.

Section 3. DL (Dorsey's Law) sequences

There is a broad class of underlying CRV syllables (R a resonant) which split and surface as CV.RV sequences, with the V reduplicated to furnish a nucleus for the first syllable; *pro* → *po.ro*, for example. See Miner (1989) for a thorough discussion. The metrical properties of DL (Dorsey's Law) sequences, as Miner called them, have been of great interest and the subject of numerous studies. An extension of (10) is needed to compute the effect of DL sequences on footing. Let δ denote the first beat of a DL sequence.

In the following examples of words with DL sequences, the initial syllables of DL sequences, called *Dorsey syllables* have been boldfaced.

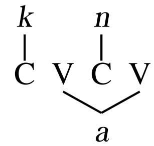
(18) Words with DL sequences (foot groups conjectured)

a.	***ke***.*re.ǰų́.sep*	δ (× ×́) ×	'Black Hawk'	M79:30
b.	*hi.*___ko___*.ro.hó*	× δ (× ×́)	'prepare, dress (3sg.)'	M79:30
c.	*ha.nip.*___šą́___*.ną*	× (× δ́) ×	'I swam (declar.)'	HWE:314
d.	***ke***.*re.*___ké___*.reš*	δ (× δ́) ×	'colorful'	M79:30
e.	*wi.*___ki___*.ri.*___pá___*.ras*	× δ (× δ́) ×	'flat bug'	HWE:131
f.	*waː.*___pó___*.ro.*___pó___*.ro*	×‿(× δ́)(× δ́) ×	'snowball'	M79:30
g.	*wa.*___ki___*.ri.*___pó___*.ro.*___pó___*.ro*	× δ (× δ́)(× δ́) ×	'spherical bug'	HWE:131
h.	*čuː.giá.*___šą___*.nąp.ké*	×‿× (×‿×́) δ (× ×́)	'kingbird'	M81:342
i.	*hi.rat.ʔát.ʔa.*___šą___*.nąk.*___šą́___*.ną*	× (× ×́) × δ (× δ́) ×	'you are talking'	HWE:130
j.	*ha.ra.kí.*___šu___*.ru.ǰík.*___šą___*.ną́*	× (× ×́) δ (× ×́)(δ ×́)	'pull taught (2 sg. declar.)'	HWE:126

Halle and Idsardi (henceforth H&I), (1995), realized that the key to understanding the metrical properties of DL sequences was the observation that a syllable directly following a DL sequence is always stressed and that this means that non-final DL sequences are split by a left foot delimiter. I follow this here but take a different approach to the mechanism which inserts the delimiter.

I suppose that DL sequences are formed before footing occurs, but that the phonology distinguishes DL sequences from other sequences of light syllables. Exactly how the necessary derivational history is built into the representation is a delicate question. I assume that at each step the phonology responds only to what the current representation is, not how it came to be what it is. One approach is to suppose that the reduplicated vowel in the first syllable of the DL sequence is the first slot of the long-distance geminate created by reduplication. See Frampton (2009) for the theoretical underpinnings of this idea.

Miner (1989, fn. 3, p. 169), in fact, suggests the representation



as a possible explanation for the fact that the nasal affects the vowels in both syllables of the DL sequence. The surface form of the DL sequence derived from *kna* is *ką.ną*, with both vowels nasalized. Although Miner does not pursue the implications of representations like this, he is in effect suggesting a general approach to explaining overapplication effects in reduplication. I was unaware of Miner's insight in writing Frampton (2009), where this idea is central to the theory developed there.

H&I's idea that a delimiter is inserted between the beats of DL sequences will be expressed here by augmenting the rules (10) with GF_δ, the rule $\delta \rightarrow \delta\langle$. This gives

(19)
$$\left.\begin{array}{l} \delta \rightarrow \delta\langle \\ \times \rightarrow \times\langle \ /\ \_\_\times\smile \\ \times \rightarrow \times\langle \ /\ \#\_\_ \\ \left[\ \times \rightarrow \times\rangle\ \right]_{\mathrm{LR}} \end{array}\right\}\ ;\ {}^{*}\mathrm{U_{NY}} \qquad \begin{array}{l} (\mathrm{GF}_\delta) \\ (\mathrm{GF}_{\mathrm{H}}) \\ (\mathrm{GF}_\#) \\ (\mathrm{GB}) \end{array}$$

GF_δ has been ordered before GF_{H}. This is simply for the sake of concreteness; I don't know any evidence for the relative order of these marking rules. As far as I know, there are no examples with non-initial cosyllabic beats which are right adjacent to DL sequences. That would decide the issue. It is, however, crucial that GF_δ and GF_{H} are more highly ranked then $\mathrm{GF}_\#$.

(20) Annotated outcomes for all the words in (18).

a. ***ke**.re.ǰų́.sep*
δ ⟪ × ×́ ⟩ ×
GF_δ GB

b. *hi.**ko**.ro.hó*
× δ ⟪ × ×́ ⟩
GF_δ GB

c. *ha.nip.**šą́**.ną*
× ⟪ × δ́ ⟩ ×
$\mathrm{GF}_\#$ GB

d. ***ke**.re.**ké**.reš*
δ ⟪ × δ́ ⟩ ×
GF_δ GB

e. *wi.**ki**.ri.**pá**.ras*
× δ ⟪ × δ́ ⟩ ×
GF_δ GB

f. *waː.**pó**.ro.**pó**.ro*
×⟪‿× δ́ ⟪ × δ́ ⟩ ×
$\mathrm{GF}_\#$ GF_δ GB

g. *wa.**ki**.ri.**pó**.ro.**pó**.ro*
× δ ⟪ × δ́ ⟪ × δ́ ⟩ ×
GF_δ GF_δ GB

h. *čuː.giá.**šą**.nąp.ké*
×‿× ⟪ ×‿×́ ⟩ δ ⟪ × ×́ ⟩
GF_{H} GB GF_δ GB

i. *hi.rat.ʔát.ʔa.**šą**.nąk.**šą́**.ną*
× ⟪ × ×́ ⟩ × δ ⟪ × δ́ ⟩ ×
$\mathrm{GF}_\#$ GB GF_δ GB

j. *ha.ra.kí.**šu**.ru.ǰík.**šą**.ną́*
× ⟪ × ×́ ⟩ δ ⟪ × ×́ ⟩ δ ×́ ⟩
$\mathrm{GF}_\#$ GB GF_δ GB GB

(18i) shows that DL upbeat marking can lead to the same phenomenon that we saw in heavy syllable upbeat marking, two adjacent unfooted beats. The FBC is responsible. This is further confirmation of the FBC. It is interesting that the second beat of a DL sequence can be stressed, as shown by (20j).

Section 4. Binary/ternary alternation

To this point, I have avoided the many words in the data in which ternary intervals separate stressed beats. Before we consider how the rules must be modified to analyze this data, some general remarks on how ternary footing comes about in the focused delimiter insertion framework are useful. Consider the two iterative rules in (21).

(21) a. $\big[\times \rightarrow \times\rangle\big]_{LR}$; *UNY (GB) b. $\begin{bmatrix}\times \rightarrow \times\rangle \\ \times \rightarrow \times\langle\end{bmatrix}$; *UNY $\begin{matrix}\text{(GB)} \\ \text{(GF)}\end{matrix}$

Because DIRs target a beat (i.e., are focused), multiple DIRs can be combined in a scheme and compete for application in the usual way. The highest ranked applicable rule applies. If the current state is

$$\cdots\ \underset{GB}{\times\rangle}\underset{\blacktriangle}{\times}\ \times\ \times\ \cdots$$

and the iterative rule is (21b), then *UNY blocks GB but GF can apply. If the current state is

$$\cdots\ \underset{GB}{\times\rangle}\times\langle\underset{\blacktriangle}{\times}\ \times\ \cdots$$

then *UNY blocks both GB and GF.

The following derivations result, with the (21a) rule illustrated in (22a) and the (21b) rule illustrated in (22b).

(22) a. $\times\ \underset{\underset{GB}{>}}{\times}\rangle\times\ \underset{\underset{GB}{>}}{\times}\rangle\times\ \underset{\underset{GB}{>}}{\times}\rangle\times\ \underset{\underset{GB}{>}}{\times}\rangle\times\ \cdots$ b. $\underset{\underset{GF}{>}}{\times}\langle\times\ \underset{\underset{GB}{>}}{\times}\rangle\underset{\underset{GF}{>}}{\times}\langle\times\ \underset{\underset{GB}{>}}{\times}\rangle\underset{\underset{GF}{>}}{\times}\langle\times\ \underset{\underset{GB}{>}}{\times}\rangle\underset{\underset{GF}{>}}{\times}\langle\times\ \cdots$

(21b) results in ternary footing of the kind that Hayes (1995) called ‘weak local parsing’.

We can return to Winnebago and consider the footing systems (23).

(23) a. *Ternary system*

$$\left.\begin{array}{l}\delta \rightarrow \delta\langle \\ \times \rightarrow \times\langle\ /\ \_\_\times\smile \\ \times \rightarrow \times\langle\ /\ \#\_\_ \\ \begin{bmatrix}\times \rightarrow \times\rangle \\ \times \rightarrow \times\langle\end{bmatrix}_{LR}\end{array}\right\}\ ;\ {}^*\text{UNARY}\quad \begin{array}{l}(\text{GF}_\delta) \\ (\text{GF}_\text{H}) \\ (\text{GF}_\#) \\ (\text{GB}) \\ (\text{GF})\end{array}$$

b. *Binary system*

$$\left.\begin{array}{l}\delta \rightarrow \delta\langle \\ \times \rightarrow \times\langle\ /\ \_\_\times\smile \\ \times \rightarrow \times\langle\ /\ \#\_\_ \\ \begin{bmatrix}\times \rightarrow \times\rangle \\ \xcancel{\times \rightarrow \times\langle}\end{bmatrix}_{LR}\end{array}\right\}\ ;\ {}^*\text{UNARY}\quad \begin{array}{l}(\text{GF}_\delta) \\ (\text{GF}_\text{H}) \\ (\text{GF}_\#) \\ (\text{GB})\end{array}$$

The systems differ only in that the GF subrule of the iterative rule in the ternary system is omitted in the binary system.

(24) All the words in data for which the ternary system (23a) makes the correct prediction and binary system (23b) does not.

a.	*wiː.rá.gų̨š.ge.rá*	×‿⟪× ×́⟩×⟨× ×́⟩	‘the stars’	M79:28
b.	*ho.ki.wá.ro.ro.kè*	×⟪× ×́⟩×⟨× ×́⟩	‘swing (v.intr.)’	M81:156
c.	*wiː.pá.mą.**ke**.rè*	×‿⟪× ×́⟩×⟨δ ×́⟩	‘rainbow’	M81:156
d.	*hiː.žú.go.ki.rùs.ge*	×‿⟪× ×́⟩×⟨× ×́⟩×	‘double-barreled shotgun’	M79:25
e.	*hi.žą.kíː.čąš.gu.nį̀*	× ×̣⟪×‿×́⟩×⟨× ×́⟩ (* under second ×)	‘nine’	M79:25
f.	*yuː.kíː.hi.nąŋ.kì*	× ×̣⟪×‿×́⟩×⟨× ×́⟩ (* under second ×)	‘if I could mix them . . . ’	H90:149†
g.	*guː.šíː.ča.nąn.rì*	×‿×⟪×‿×́⟩×⟨× ×́⟩	‘the day before yesterday’	H90:149†
h.	*teː.ǰą́.ňa.ǧop.kè*	×‿⟪× ×́⟩×⟨× ×́⟩	‘pelican’	M81:342
i.	*nįː.wá.ką.čąg.rà*	×‿⟪× ×́⟩×⟨× ×́⟩	‘Devil’s Lake, Wisconsin’	M81:342
j.	*hųː.wą́.žug.wi.rà*	×‿⟪× ×́⟩×⟨× ×́⟩	‘September (elk-call month)’	M81:342
k.	*mą́į.ta.wus.hì.ra*	×‿×́⟩×⟨× ×́⟩×‡	‘May (earth-drying month)’	M81:342

† Halle credits these to K. Hale (p.c.).
‡ There is exceptional stress on the first syllable, but what follows is ordinary ternary footing. I assume here that what is exceptional is that edge-marking does not apply, although other explanations are possible. (16d) has an initial diphthong which is split, so the diphthong cannot simply be blamed for the failure of syllable splitting.

(25) All the words in data for which the binary system (24b) makes the correct prediction and ternary system (24a) does not.

a.	*waː.rá.gų̨š.gè.ra*	×‿⟨× ×́⟩× ×́⟩×	‘the stars’	HWE:118
b.	*haː.kí.tu.ǰík.**šą**.ną̀*	×‿⟪× ×́⟩× ×́⟩δ ×́⟩	‘pull taught (1sg. declar.)’	HWE:126
c.	*ha.ki.rú.ǰik.**šą̀**.ną*	×⟪× ×́⟩× δ́⟩×	‘pull taught (3sg declar.)’	HWE:126
d.	*haː.kí.tu.ǰík.ga.ǰą̀*	×‿⟪× ×́⟩× ×́⟩× ×́⟩	‘after I pull taught’	M89:152
e.	*ha.ki.rú.ǰik.gà.ǰą*	×⟪× ×́⟩× ×́⟩×	‘after he pulls taught’	M89:152

Contrast (24a) *waː.rá.gų̨š.ge.rà*, from Miner (1979), with (25a) *waː.rá.gų̨š.gè.ra*, from Hale and White Eagle (1980). It is the only word which appears in both data sets. Aside from that example, the other four examples are different forms of the same verb.

All of the data from Miner (1979, 1981) is stressed as desired by the ternary system; all of the data from Hale and White Eagle (1980) and Miner (1989) are stressed as desired by the binary system. This is sufficient evidence to show that the binary/ternary alternation in Winnebago is a real phenomena, not just a data artifact, and to conclude that theories of Winnebago stress must have an explanatory account of the alternation. In Estonian there is binary/ternary variation explained by optionally dropping GF from the iterative scheme. It seems that it is best described by making the GF subrule of the iterative rule optional, with the option under the control of individual speakers. It is hard to be sure without access to the raw data or fieldwork, but it seems reasonable to speculate that individual Winnebago speakers have one of the two grammars, binary or ternary. The fact that the variation is not randomly scattered, but that the ternary pattern is concentrated in the early Miner data, suggests that the variation is dialectical. It is possible that Hale and White Eagle, on the one hand, and Miner, on the other, sampled different subpopulations of Winnebago speakers. The fact that the variation is not randomly scattered, but that the ternary pattern is concentrated in the early Miner data, suggests that the variation is dialectical. It is possible that Hale and White Eagle, on the one hand, and Miner, on the other, sampled different subpopulations of Winnebago speakers.

4.1 Syllable Integrity

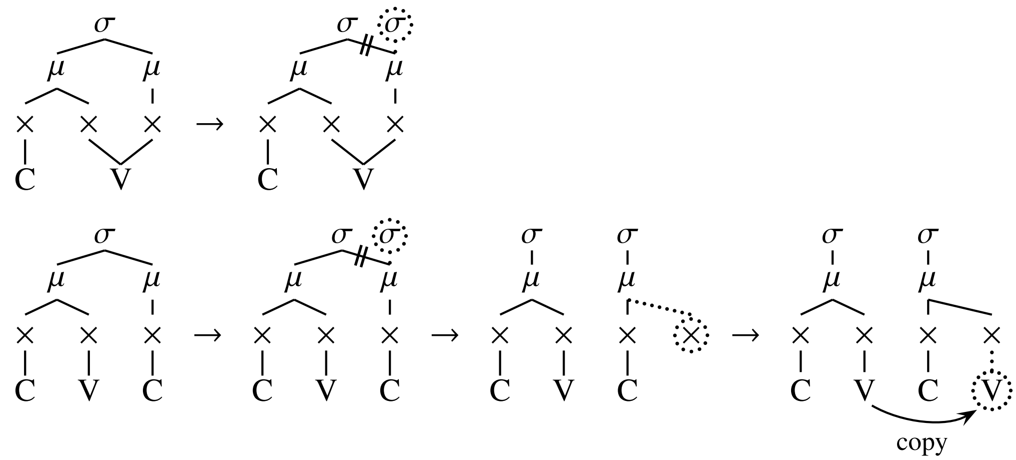
Section Section 2 relied on splitting word-initial cosyllabic pairs with a left delimiter, inserted by $GF_{\#}$. This contradicts the principle of Syllable Integrity in the form that was originally proposed by Prince (1976). He proposed that the rules of foot construction cannot split syllables, as a derivational constraint. I assume a weaker version of Syllable Integrity and take it to be a condition on representations at some level, not an output condition on rules (i.e. not a derivational constraint). If suitable repair operations are available, which produce representations satisfying *SPLITSYL, languages can choose to allow derivational syllable splitting in some or all contexts.

Frampton (2008, p. 245) proposed that if more or less automatic repair was available, a language could contain a foot delimiter insertion rule which violated Syllable Integrity. The idea of derivational violation of a basic phonological principle followed by later repair to satisfy the principle (as a condition on representations at some level) is developed in Frampton (2009). It is pointed out there that much work in autosegmental phonology which relies heavily on the No Crossing Constraint, makes a similar assumption. If Syllable Integrity is an output condition at some level, the simplest way to ensure that it is satisfied to impose it as a derivation constraint. There is therefore a strong tendency to avoid violations altogether. But certain exigencies may prompt a grammar to allow derivational violation and later repair.

Certain Syllable Integrity violations are much easier to repair than others. Contrast (26a) and (26b), which shows what is involved in splitting bimoraic syllables into a sequence of monomoraic syllables. It compares splitting and repairing a CVV syllable and a CVC syllable.

(20) a.

b.



If (20a) is needed to repair a Syllable Integrity violation, the cost is relatively small. There are other ways that a split CVC repair might be carried out, but in (21b) I supposed it was something like Dorsey splitting. It is clearly a much more complex operation than what is required in (21a). In general, languages obey Syllable Integrity derivationally, but some languages allow CVV splitting with the repair (20a). As far as I know, there are no languages that allow CVC splitting in response to footing demands, but there is no reason that it should be ruled out in principle.

Now consider the claim that $GF_{\#}$ violates Syllable Integrity if there is an initial heavy syllable. Heavy syllables in Winnebago, are (C)VV(C) at the point in the derivation that the footing rules apply. They can be restructured as a (C)V.V(C) sequence of two light syllables, at some (relatively modest) cost. What is the benefit? Allowing $GF_{\#}$ to split heavy syllables means that all words begin with an unfooted syllable and stress on the third mora. It is plausible that the benefit of prosodic uniformity at the leading edge of words is worth the cost of Syllable Integrity driven repair.

Why is it only $GF_{\#}$ that violates Syllable Integrity? Hayes points out that Miner's (1979) analysis of the development of Winnebago accent from an earlier Siouan language as tone shift to the right is useful in understanding the Winnebago marking rules. Although Hayes pursues a different idea, he mentions that "Tone Shift might be construed as a wholesale Prosody Shift." What might a wholesale prosody shift look like? I interpret it to be a shift from the basic marking operation $\times \rightarrow \langle\times$, which marks $\times$ as an downbeat, to $\times \rightarrow \times\langle$, which marks $\times$ as a upbeat. This is akin to musical syncopation.

Ignoring marking rule order and ignoring the possibility that footing took place before Dorsey splitting in the earlier language, a 'perfect prosodic shift' would be (21).

$$
\text{(21)}\quad
\begin{array}{lll}
\times \rightarrow \langle\times \,/\, \_\_\smile\times & & \times \rightarrow \times\langle \,/\, \_\_\smile\times \\
\delta \rightarrow \langle\delta & \longrightarrow & \delta \rightarrow \delta\langle \\
\times \rightarrow \langle\times \,/\, \#\_\_ & & \times \rightarrow \times\langle \,/\, \#\_\_
\end{array}
$$

This shift would split all non-final bimoraic syllables, at considerable computational cost. Instead of a 'perfect shift', Winnebago avoided the problem of wholesale bimoraic syllable splitting by keeping GF_H upbeat marking, but applying it to the beat preceding the heavy syllable. Prosodic shift therefore furnishes a possible account of how Winnebago's relatively complicated array of marking rules may have developed.

Syllable Integrity therefore gives an account of why marking heavy syllables is different than marking the word edge. The former in effect, marks the beat before the beats of the heavy syllable. The later marks the word edge directly. This difference corresponds, in Hayes' tone shift analysis, to the stipulation that tone cannot shift off a heavy syllable.

4.2 More on moraic beats

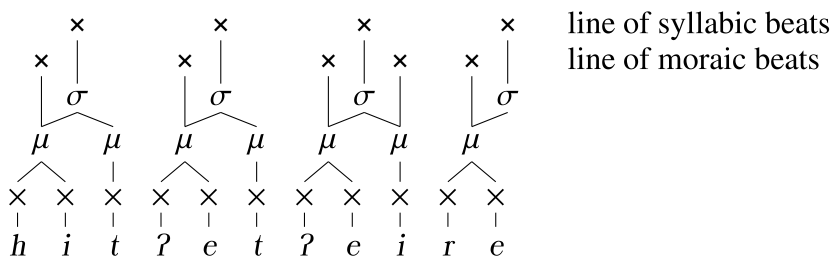
Some points were not adequately addressed in the analysis which has been done to this point.

Earlier, in (15c), the derivation of *hit.ʔet.ʔéi.re* was summarized as

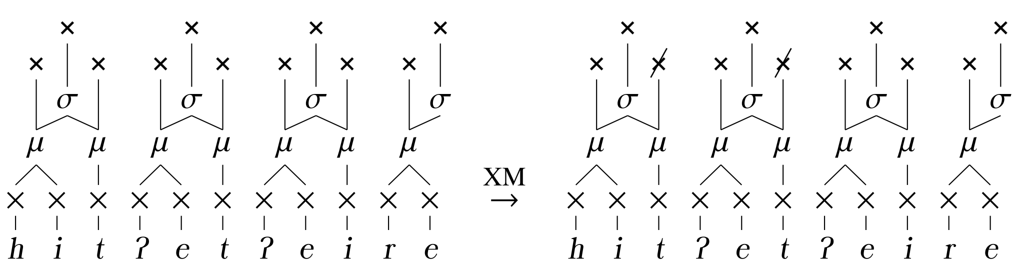
(22) $\times\ \ \times\ \ \times\!\smile\!\times\ \ \times \quad\rightarrow\quad \times\ \ \underset{GF_H^x}{\underset{>}{\times}}\langle\!\langle \times\!\smile\!\underset{GB}{\underset{>}{\acute{\times}}} \rangle \times$

How was the initial representation (on the left) computed?

In the literature, one reads things like (C)VC syllables 'count as light'. Exactly what this means is not spelled out. How is this counting done and how is the count used? I assume that at some point the representation is (23). Certain moras are *extrametrical*. That is, they have a syllabic persona, but not a metrical persona (an associated metrical beat).

(23) 

(23) can be produced in two ways. One way is to make beat projection part of syllabification, with a rule built into the syllabification rules which determines which moras are projected. The other is to assume that beats are automatically projected and that extrametricality is established by a beat deletion operation (XM), as shown in (24).

(24) 

It is worth noting that the missing beats in (24) are significant not only in footing the line of moraic beats, but would also be in footing the line of syllabic beats, if that were called for. Footing the line of syllabic beats requires assigning a +HVY property to certain syllabic beats. It corresponds not to bimoraic syllables, but to syllables that are *metrically bimoraic*, those that have 2 moras which project moraic beats. In (24), only the 3rd syllable is heavy. The 1st and 2nd syllables are bimoraic, but metrically monomoraic.

So for mora-counting footing, what the footing process sees is (25a), the line of moraic beats. For syllable-counting footing, (25b) is seen.

(25) a. × × ×‿× ×

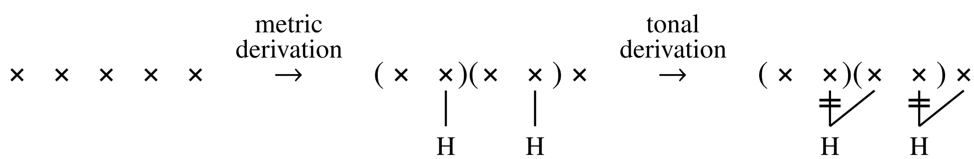
b. L L H L = × × $\underset{\text{[+HVY]}}{\times}$ ×

Section 5. Other analyses

5.1 Hayes (1995)

Hayes develops Miner's idea that Winnebago underwent wholesale tone shifting into a synchronic account of Winnebago stress. The analysis is a mixed metrical/tonal analysis of stress. The basic idea is that stress is realized as tone and that tone shifting follows the metrical derivation and stress assignment. What appears as surface stress is tone that has been first associated with stress, but then undergone tone shift.

Hayes derives the stress pattern of *hokiwárokè* 'swing (n.)', for example, as in (26).

(26)


The metric analysis is straightforward LR iambic footing, with high tone the acoustic correlate of foot stress. Tonal rules follow, which shift stress to the right. The theory makes almost all of the correct predictions.

The weakness of the analysis is that the number of choices available in footing and then in tone shift, the latter with a number of rules which operate in very specific environments, give so many points of adjustment that fitting the empirical facts is not a compelling argument for the theory. There is a rule, for example, which shifts tone off light syllables and initial heavy syllables, but not off non-initial heavy syllables. There is no argument that initial heavy syllables group with light syllables or for why tone shifts off light syllable but not heavy syllables. Hayes admits that the tonal rules "have properties that look metrical in character."

The most appealing aspect of the analysis is the explanation of the fact that a syllable immediately following a DL sequence is invariably stressed. In the metrical stage of derivation the Dorsey syllable is bimoraic, hence gets high tone, the expression of stress.

Afterward, Dorsey splitting takes place, with high tone on the second syllable of the DL sequence. Then it migrates to the following syllable under Tone Shift. For example,

$$(\ \overset{\text{H}}{\overset{|}{pras}}\ )\ (\ \sigma \cdots \xrightarrow{\text{Dorsey's Law}} (\ pa\ \overset{\text{H}}{\overset{|}{ras}}\ )\ (\ \sigma \cdots \xrightarrow{\text{Tone Shift}} (\ pa\ ras\ )\ (\ \overset{\text{H}}{\overset{|}{\sigma}} \cdots$$

Unfortunately, although the idea is appealing and comes close to predicting the facts, it does not account for all the facts. It fails, for example, to predict the interior stress lapse in *hi(rat.ʔát)ʔa.šą(nąk.šą́)ną*. The analysis in Hayes' theory is given in (27).

(27) $$(ha.\overset{\text{H}}{\overset{|}{rat}})(ʔat.\overset{\text{H}}{\overset{|}{ʔa}})(\overset{\text{H}}{\overset{|}{šnąk}})(\overset{\text{H}}{\overset{|}{šną}}) \xrightarrow{\text{Dorsey's Law}} (ha.\overset{\text{H}}{\overset{|}{rat}})(ʔat.\overset{\text{H}}{\overset{|}{ʔa}})(šą.\overset{\text{H}}{\overset{|}{nąk}})(šą.\overset{\text{H}}{\overset{|}{ną}})$$

$$\xrightarrow{\text{Tone Shift}} (ha.rat)(\overset{\text{H}}{\overset{|}{ʔat}}.ʔa)(\overset{\text{H}}{\overset{|}{šą}}.nąk)(\overset{\text{H}}{\overset{|}{šą}}.\overset{\text{H}}{\overset{|}{ną}}) \xrightarrow{\text{Tone Deletion}} (ha.rat)(\overset{\text{H}}{\overset{|}{ʔat}}.ʔa)(\overset{\text{H}}{\overset{|}{šą}}.nąk)(\overset{\text{H}}{\overset{|}{šą}}.ną)$$

The prediction of a medial tone is incorrect.

Recall the derivation (18i), which gives an account of the 2 beat gaps.

(28) $$\times\ \times\ \times\ \times\ \delta\ \times\ \delta\ \times \;\rightarrow\; \times\ \times\ \times\ \times\ \underset{GF_\delta}{\underset{>}{\delta}}\langle\!\langle\times\ \delta\ \times \;\rightarrow\; \underset{GF_\#}{\underset{>}{\times}}\langle\!\langle\times\ \times\ \times\ \underset{GF_\delta}{\underset{>}{\delta}}\langle\!\langle\times\ \delta\ \times \;\rightarrow$$

$$\underset{GF_\#}{\underset{>}{\times}}\langle\!\langle\times\ \underset{GB}{\underset{>}{\times}}\rangle\times\ \underset{GF_\delta}{\underset{>}{\delta}}\langle\!\langle\times\ \delta\ \times \;\rightarrow\; \underset{GF_\#}{\underset{>}{\times}}\langle\!\langle\times\ \underset{GB}{\underset{>}{\times}}\rangle\times\ \underset{GF_\delta}{\underset{>}{\delta}}\langle\!\langle\times\ \underset{GB}{\underset{>}{\delta}}\rangle\times$$

GB cannot apply to the first Dorsey beat because GF_δ has already applied to it. There is nothing corresponding in Hayes' analysis and it is difficult to see how this idea could be adapted to that theory.

In sum, although the account of the post-accenting properties of Dorsey's syllables is appealing, the complexity of the analysis (both a prosodic and a tonal derivation are required) and the empirical problem noted above make it unsatisfactory.

5.2 Halle and Idsardi (1995)

H&I's approach to deriving the post-accenting properties of Dorsey syllables is to suppose that Dorsey syllables are underlying monomoraic syllables, but are marked like heavy syllables by inserting a left delimiter before the beat corresponding to the Dorsey syllable. Dorsey splitting then intervenes in the footing process and applies before iterative footing.

The appealing aspect of this proposal is that, prior to footing, nothing special needs to be said about Dorsey syllables; they behave just like a heavy syllable. My account needed to specify a marking rule that acted on the DL sequence, as if remembering its past status as a single syllable.[2] H&I's account needs to specify a marking rule that acts on a monomoraic syllable, as if anticipating its future status as bimoraic.

2. In fact, the phonology does appear to remember the underlying status of DL sequences in some way, to the extent that it has a phonetic effect. Miner (1979, p. 26) calls DL sequences "fast sequences" and says that "the sequences are spoken (and apparently, sung) faster than normal CVCV sequences."

The problematic aspect of H&I's analysis is the mechanics which must be stipulated for the interaction of delimiters and Dorsey epenthesis; the added beat is assumed to come before the delimiter, as illustrated in (29).

$$\begin{array}{llclcl} & \;\;\;\;* & & \;\;\langle\, * & & \;\;*\,\langle\, * \\ & \;\;\;\;| & \text{Dorsey marking} & \;\;\;\;| & \text{Dorsey epenthesis} & \;\;|\;\;\;\;| \\ (29) & \cdots\text{pra}\cdots & \rightarrow & \cdots\text{pras}\cdots & \rightarrow & \cdots\text{pa ras}\cdots \end{array}$$

No justification or even plausibility argument is given.

Finally, H&I have only a stipulative solution to the problem of accounting for the many instances of medial stress lapse in *hi.rat.ʔát.ʔa.šą.nąk.šą́.ną* and related examples (12d,c) involving lapses before heavy syllables. They impose the otherwise unmotivated derivational constraint *⟩⟨, which achieves empirical adequacy, but is not explanatory.

The biggest weakness in the Halle and Idsardi (1995) analysis of Winnebago is that it has nothing to say about ternary patterns. Idsardi (1992, p. 26–32) did discuss the ternary patterns in Cayuvava and Chugach. The analysis of Chugach requires 2 directional iterative rules, one LR and the other RL.

Section 6. Conclusion

The goal of this paper was to show that refining the H&I analysis of Winnebago word prosody by reformulating the delimiter insertion rules so that they apply to single beats allows a more explanatory and more complete analysis of Winnebago. It is more explanatory because it eliminates a *⟩⟨ derivational constraint and replaces it by a general principle, the Free Beat Condition. It is more general because gives a way to analyze the ternary patterns found in Winnebago. Not only can the ternary forms be analyzed, but the analysis shows how the binary/ternary variation which is found is a natural reflection of a simple variation in the footing rules.

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