FOOT AND SYLLABLE IN SOUTHERN PAIUTE

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## 1. Introduction.[1]

This paper shows that Southern Paiute (SP), a Shoshonean language, may assign adjacent, tautosyllabic vowels to separate feet. This violates Syllable Integrity (SI -- see (1)). SP counts vowels, not syllables, in its stress system, yet syllables are necessary to account for phonotactics and some morpheme alternations. I will show that the syllables we need to account for these phenomena do not always respect the foot structure that's part of the stress system, resulting in violations of SI.

(1) Syllable Integrity prohibits: …(v][v)(v][v)…, where syllable boundaries are shown by square brackets and foot boundaries by parentheses. Equivalently: No language may make a contrast between tautosyllabic v́v and vv́.

Daniel Everett (1996) presents convincing evidence that Banawá, an Amazonian language, violates SI. He argues that UG must be able to accommodate representations where a single syllable may be split between two feet. On this basis, it appears that "three dimensional phonology" (Halle & Vergnaud, 1987; Halle & Idsardi, 1995) is a better candidate for membership in UG than the prosodic hierarchy (e.g., Selkirk, 1980; Selkirk and Shen, 1990). The latter fails, as does any theory that assumes the syllable is inviolably the stress bearing unit (e.g., Hayes (1995)); any such theory renders UG unable to represent violations of SI. The SP facts discussed in this article strengthen Everett's argument.

Everett's evidence, along with the SP evidence, favor three dimensional phonology over the prosodic hierarchy. It says little to nothing about the debate between OT and derivational theories of phonology. This paper is more about a theory of representation in phonology as part of UG, than it is about how these representations are created and modified by other components of UG.

The prosodic hierarchy is widely assumed in the literature to be the confirmed theory of representation. For example, Blevins (1995), citing Hayes, says that no language may make a contrast between a tautosyllabic v́v and vv́, and she traces the concept of syllable integrity to Prince (1975). And, as is well known, the prosodic hierarchy has been adopted by OT, although there is no necessary connection between the two.

Hayes (1995) is forced to argue away the SP phenomena, claiming that all vv sequences are really bisyllabic; therefore, the stress rule can count syllables instead of vowels. This paper shows that Hayes' arguments are not consistent with facts uncovered in further investigations of SP phonology. We will see evidence that SP, which is iambic, may designate sometimes the first, and sometimes the second vowel of a tautosyllabic vowel sequence as head of a foot. The choice is governed solely by a vowel count, starting at the left edge of the word -- a vowel will be

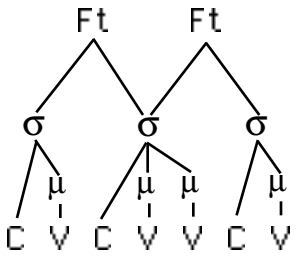
designated as head of an iambic foot if and only if it is nonfinal and an even number of vowels away from the left edge of the word. SP has a productive allophonic process of vowel devoicing that serves as a useful diagnostic tool for determining foot structure. All word final vowels devoice. A nonfinal vowel devoices if it is both the weak member of a foot and precedes a geminate obstruent.

The capstone example in this paper involves a lexical stem of the form /papapaa/, where the last two vowels are demonstrably tautosyllabic (I am using Sapir's (1949) designation of /p/ for obstruent and /a/ for vowel). In our example, this stem is followed by a suffix of the shape /-ppapaa/ where the first two p's refer to a geminate obstruent. In a word consisting of just this stem and suffix (i.e., /papapaa+ppapaa/), stress falls on the second of the adjacent vowels in the stem (underlined); /papàpaa̲ppapàa/. The vowel we are interested in is the head of an iambic foot, and therefore not susceptible to devoicing.

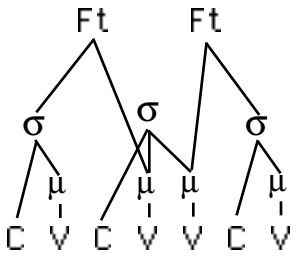
If we add a monomoraic element to the left of the same stem (so it's now /nam+papapaa+ppapaa/), the vowel count is shifted to the left by one, and stress now falls on the first of the adjacent vowels: /nampàpapàa̲ppàpaa/. The vowel we are watching is now the weak member of the foot headed by the vowel that follows it; our vowel devoices, because it also precedes a geminate obstruent: [nampàwawàA̲ʰpàwaA] (see below for an explanation of phonetic details). This is a clear violation of SI; the behavior of tautosyllabic v̊v differs dramatically from that of tautosyllabic vv̊.

How might violations of SI be represented in the two theories, the prosodic hierarchy and three dimensional phonology? The SP evidence will show that a successful theory must be able to generate a single syllable with two vowels, such that the left one is the head of the left iambic foot and the right one the weak member of the right iambic foot. The theory of the Prosodic Hierarchy generates syllables as constituents of feet; according to this theory, it may be mathematically impossible to produce such objects. One might propose an "ambifooted syllable" analysis, as shown in (2a). The problem with (2a) is that it does not clearly specify that the left vowel of the shared syllable is the head of the left foot, and the right vowel in the same syllable is the weak member of the right foot. It merely says that the syllable in question is shared by two feet. (2b) overcomes these infelicities of (2a) but has other serious problems. For example, each of the two feet dominates one syllable and one mora, and they do so just when there is an unparsed syllable also dominating those same moras. This is so hopelessly ad hoc and unnatural, that we can safely assume that UG does not compute (2b).

(2a) "Ambifooted" Representation




(2b) "Line-crossing" representation

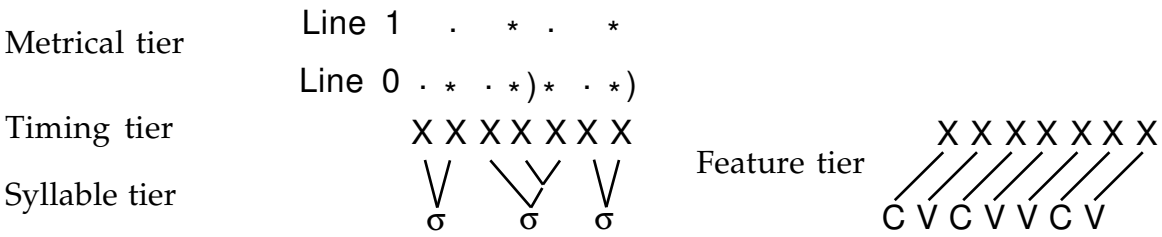



Halle's theory of three dimensional representation, by contrast, places syllables and feet on orthogonal planes. Feet are defined as constituents of marks on a metrical plane; they do not literally gather syllables or elements on the timing tier. This theory does not require feet and syllables to be aligned. The Halle & Idsardi theory would represent structures that violate SI with a three dimensional graph, as in (3). This is three dimensional in the sense that there are several half planes radiating from a central axis, the timing tier -- represented by the series of 'X's. One radiating half plane is the feature tier, indicated in (3) by "C" and "V" symbols standing for feature geometric representations. There are two other half-planes in (3), the metrical tier and the syllable tier. The syllable tier represents only the organization of segments by syllables; there are no elements that in turn dominate the syllables.

A foot on the metrical tier is any string of marks (asterisks) to the left of a right bracket (or to the right of a left bracket), until reaching either another bracket or the edge of the graph. The first foot boundary on Line 0 is not aligned with a syllable boundary, so this is a violation of SI.

The heads of feet are represented on Line 1; the SP iambic foot pattern is shown by the Line 1 asterisks above the right members of the Line 0 feet.

(3) Three dimensional representation:




The SP evidence suggests that the theory of representation in (3) is superior to that in (2), because it clearly designates the left-hand of the two tautosyllabic vowels as a head of the foot. A variety of evidence suggests strongly that SP syllables and stress facts are as shown in (3), suggesting that representations cast within three

dimensional phonology are more empirically successful than within the prosodic hierarchy.

If the argument that SP violates SI is to be taken seriously, I must first prove that the syllable structure is as I claim it to be, and I must also justify my proposed foot structure. First, we must cover a little background about SP phonology.

**2. A phonological sketch of Southern Paiute.**

The inventory of the contrastive elements of Southern Paiute is provided in (4). We may ignore various details of the consonant inventory for the purposes of this paper. However, it is of interest to note that /s/ and the nasals always appear geminated. Sapir (p 46) speculated that single, intervocalic /s/ and the nasals dropped out between proto-Shoshonean and SP; we will return to this point in the conclusion. Other than /s/, all obstruents could appear either as geminates or as singletons.

(4) Segmental Inventory of Southern Paiute, following Sapir (1930).

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | m | n | | ŋ | | | |
| | | | p | t | | k | $k^w$ | ʔ | |
| i | ï | u | | č | | | | | |
| | | | | s | | | | | (h) |
| | a | o | w | | y | | | | |

Sapir observed that diphthongs were very common, and occurred both within morphemes and across morpheme boundaries. A search of Sapir's dictionary reveals that there were virtually no restrictions on vowel sequences: see (5).

(5) Vowel sequences occurring within stems listed in Sapir's dictionary of Southern Paiute. The top row indicates the second member of possible sequences, the left column the first. '√' means that the sequence is attested, '✗' that it is not.

| | -i | -ï | -u | -a | -o |
|---|---|---|---|---|---|
| i- | ✓ | ✗ | ✓ | ✓ | ✓ |
| ï- | ✓ | ✓ | ✓ | ✓ | ✗ |
| u- | ✓ | ✗ | ✓ | ✓ | ✗ |
| a- | ✓ | ✓ | ✓ | ✓ | ✓ |
| o- | ✓ | ✗ | ✗ | ✓ | ✓ |

(5) shows "long" vowels as sequences of two identical vowels, no different from diphthongs. "Long" vowels and diphthongs in fact behave identically in every phonological respect in SP. The "long" vowels function like diphthongs in that the devoicing that affects the second half of a diphthong also affects the second half of a long vowel in exactly the same way. "Long" vowels obey neither geminate integrity nor the OCP.

**3. Southern Paiute syllable structure.**

Sapir (p. 37) describes SP syllables as in (6):

(6) Every Paiute syllable consists, properly speaking, of a vowel (long or short) or diphthong preceded, or unpreceded, by a consonant (e.g. *u-*, *o:-*, *ai-*, *pï-*, *to:-*, *pai-*); or of such a primary syllable stopped by a nasal consonant (*m*, *n*, *ŋ*) that is itself followed by a stopped consonant or *w* (e.g., *aŋ-qa-*, *ain-tsï-*, *tïŋ-qa-*, *va:n-tï-*, *nïŋ-wï-*). It is somewhat doubtful whether vowels followed by geminated consonants are to be considered as ending their syllable or not (e.g. *ap:ïi-* as *a-p:ïi* or *ap-pïi-*). Morphology and the unvoicing of vowels suggests the former; direct phonetic observation apparently the latter.

To paraphrase, SP syllables have optional onsets, both word initially and medially. Each syllable contains one or two vowels, each mora bearing. If we adopt Sapir's "direct phonetic observation" and consider the geminates to be split by a syllable boundary, then both long and short syllables may be closed (except word finally --all words end in a vowel); the consonant closing a syllable is always either a nasal (homorganic to the following consonant), or the first half of a geminate.

Now, what of Hayes' claim that every vowel is a separate syllable in SP? Sapir would not have agreed -- he analyzed most sequences of two vowels as tautosyllabic; there are some revealing exceptions to this, which we will visit in a moment. In fact, Sapir provided evidence from three sources that suggest that, in general, long vowels and diphthongs had to be tautosyllabic. The first was his report of "direct phonetic observation," alluded to in the quote in (6).

Second, Sapir provided phonotactic arguments: No "organically" (i.e., underlying) long vowel may appear as the left half of a diphthong, where I assume that "diphthong" is implicitly taken to refer to a tautosyllabic vowel sequence. Sapir accounts for this distributional constraint by ruling out trimoraic syllables.

Can we claim, as Hayes would have to, that each vowel is in a separate syllable, and that the constraint that Sapir formulated to rule out trimoraic syllables should really be cast as a constraint against any sequence of three vowels, ignoring syllable structure? We will see an example below indicating that this is not a plausible approach.

The third piece of evidence supporting Sapir's analysis of syllable structure is the behavior of vowel sequences across morpheme boundaries. When short stem final and suffix initial vowels meet across a morpheme boundary, both are always preserved. The examples in (7) illustrate this phenomenon.

(7) Examples of …V-V… phenomena ('+' indicates morpheme boundary; Pp 16 - 18, Sapir 1929; secondary stresses inferred — CC).

| | Underlying | Phonetic | Gloss |
|---|---|---|---|
| a | tïmpa+ya+aŋa | tïmpáyaàŋA | his mouth (obj) |
| b | suukï+i?ni+ni | súγïì?ninI | my sugar |
| c | kuna+i?ni+a+taŋʷa | qunái?nìaràŋʷA | our (inclus) fire (obj) |
| d | ma+up:a?a | maúp?:a?ª | in that way |

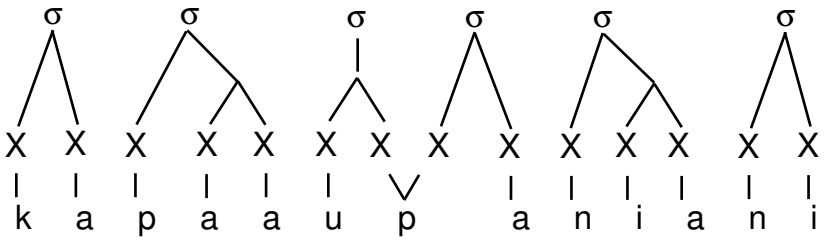
However, if the stem ends in a "long" /a/, and the suffix begins with /i/, the result was [ai]; that is, the first vowel shortened; see example (8a). This is readily accounted for by Sapir's trimoraic constraint on SP syllables, assuming of course that we analyze the resulting shortened /a/ and /i/ as tautosyllabic. Sapir (p. 17) himself attributed the shortening in (8a) to this constraint.

If the stem ends in a "long" /a/, and the suffix begins with /u/, however, Sapir said that "apparently a:-u … remains as disyllabic a:-u… Had [a shortened and tautosyllabic CC] qavau- resulted, the form in (8b) would have been" as illustrated in (8c), as we will see when we turn to the process of vowel devoicing. So, now we know that the syllabification algorithm must assign underlying /aai/ to a single syllable, with concomitant vowel shortening. The sequence /aau/, on the other hand, is syllabified as two syllables, as illustrated in (9).

(8) Vowel shortening vs. hiatus across a morpheme boundary (p. 17)

| | Underlying | Phonetic | Gloss |
|---|---|---|---|
| a | sïp:upaa+in?ni+ti +kaim:ii | sIʰpúv?ain:incìγaìm:iʰ | is wont to have cold water |
| b | kapaa+up?:ania+ni | qaváa.ùp?:anìanI | I am like a horse |
| c | " | *qaváUp?ànìànI | " |

(9) Syllable structure of (8b)




The fact that SP distinguishes between environments where shortening is obligatory, like (8a), and those where it does not occur, like (8b), shows that SP differentiates between vowel sequences which are tautosyllabic and sequences which are heterosyllabic. Hayes' conjecture would perforce analyze all vowel sequences as heterosyllabic, rendering us unable to harness Sapir's insights about syllable structure to explain the shortening in (8a).

So, to conclude this section, we know that at least the vowel sequence /ai/, as in (8a), is tautosyllabic. That is enough for our purposes, but it is also reasonable to assume that other vowel sequences also combined as diphthongs.

**4. Southern Paiute word stress.**

The passage in (10) is a slightly abbreviated quotation of a paragraph in Sapir's 1929 book *The Southern Paiute Language* where he summarizes the SP accentual pattern.

(10) In Southern Paiute accentuation is governed primarily by moras, not syllables. The fundamental law of accentuation is a *law of alternating stresses*. According to this all odd moras are "weak" or relatively unstressed, all even moras are "strong" or relatively stressed. The theoretically strongest stress of the word comes on the second mora. Hence, all words beginning with a syllable containing an organic long vowel … are accented on the first syllable; … On the other hand, all words beginning with a syllable containing an organic short vowel … are accented on the second syllable, unless the second syllable is final and therefore unvoiced, in which case the main stress is thrown back on the first syllable … Aside from the final mora, which is always unvoiced, only a weak mora may be unvoiced.

To paraphrase in a contemporary framework, Sapir said that stress was assigned by an iambic, left to right, foot assigning algorithm. This algorithm targets nonfinal vowels; notably, not syllables. The strongest stress is on the first vowel.

The examples in (11) illustrate the accentual laws described by Sapir. For example, (11f) shows that the second half of a diphthong becomes devoiced if it both appears as the weak member of an iambic foot and precedes a geminate obstruent. (11g) demonstrates that when the second mora of a diphthong bears stress, it preserves voicing. These examples clearly demonstrate that SP violates SI.To complete the

demonstration that SP violates SI, we now move on to a discussion of spirantization, vocalic devoicing, and degemination.

(11) Accentual patterns of Southern Paiute words. Capital letters mean "voiceless."

| | underlying form | phonetic form | gloss |
|---|---|---|---|
| a | ma+nčï+pï+pï | mančívïP̄I | bone from elbow to wrist |
| b | nakam:i+yï+ni | naɣám:iyï̀nI | I am sick |
| c | aï+kani | aï̀ɣanI | new house |
| d | ma+n:oatu+p:ïkaa | man:óarùp:ïɣàʰ | jumped to hold him down |
| e | " | *man:óarUp̀ïɣaʰ | " |
| f | im:i+a+s:ampa | im:íAʰšàmpA | thee only (obj.) |
| g | pïn:i+nʔui+k:ai+p:ïkaa | pïn:íǹʔuìq:aìp:ïɣàʰ | they stood and looked |

## 5. Spirantization, vocalic devoicing, and degemination

The chart in (12) [see next two pages] illustrates the patterns of spirantization, vocalic devoicing, and degemination in SP. This chart is modeled on Sapir (1949) and Chomsky and Halle (1968); I have added various items, along with attested examples of each schematized example. First, singleton obstruent stops spirantize postvocalically, (13).

(13) The reflexes of spirantization:

| | p | t | k | kʷ |
|---|---|---|---|---|
| Underlying: | | | | |
| Spirantized: | β | r | ɣ | ɣ̇ʷ |

Sapir's description of vocalic devoicing (p 39, 40) is in (14).

(14) Aside from the next to the last mora, which is always preserved intact …, every weak [i.e., unstressed] mora standing before a geminated stop … or sibilant … loses its voice. A diphthong or long vowel can be partly unvoiced only when its second mora is weak … The law of alternating stresses necessarily means that there is a constant alternation of voiced and unvoiced … vowels in non-final syllables of related words.

(12, i) SCHEMATIZATION OF SOUTHERN PAIUTE STRESS RELATED DATA

Below is a chart modeled after Sapir, 1949, extended using data from Sapir, 1930.

| | | |
|---|---|---|
| p = obstruent | pp = geminate obstruent | w = fricative |
| a = vowel | á = primary stress | à = secondary stress |
| aa =two vowels | m = nasal consonant | W, A, M = voiceless |

| | PHONOLOGICAL | PHONETIC |
|---|---|---|
| a | papa | páWA |
| b | papaa | pawáA |
| c | paapa | paáWA |
| d | paapaa | paáwaA |
| e | pappa | páppA |
| f | pappaa | pApáA |
| g | paappa | paáppA |
| h | paappaa | paáppaA |
| i | mapapa | mawáWA |
| j | mapapaa | mawáwaA |
| k | mapaapa | mawáaWA |
| l | mapaapaa | mawáawàA |
| m | mapappa | mawáppA |
| n | mapappaa | mawáppaA |
| o | mapaappa | mawáappA |
| p | mapaappaa | mawáApàA |
| q | mappapa | MApáWA |
| r | mappapaa | MApáwaA |
| s | mappaapa | MApáaWA |
| t | mappaapaa | MApáawàA |
| u | mappappa | MApáppA |
| v | mappappaa | MApáppaA |
| w | mappaappa | MApáappA |
| x | mappaappaa | MApáApàA |
| y | mappapappaa | MApáWApàA |
| z | mappappappaa | MApáppApàA |

(12, ii) ATTESTED EXAMPLES, SOUTHERN PAIUTE DATA

Below are examples drawn from Sapir (1930), somewhat normalized.

| | PHONOLOGICAL | PHONETIC | GLOSS |
|---|---|---|---|
| a | tïpa | tɪ́ɸA | pine-nut (nom) |
| b | tïpaa | tïβáA | pine-nut (acc) |
| c | kaipa | kaɪ́ɸA | mountain (nom) |
| d | kaipaa | kaɪ́βaA | mountain (acc) |
| e | pukkʷi | púkkʷI | bladder (nom) |
| f | pukkʷia | pukkʷɪ́A | bladder (acc) |
| g | païppi | paɪ́ppI | blood (nom) |
| h | païppia | paɪ́ppiA | blood (acc) |
| i | nïpapi | nïβáɸI | snow (nom) |
| j | nïpapia | nïβáβiA | snow (acc) |
| k | nakaayï | naɣáayI | puts on clothing |
| l | kapaakai | kaβáaɣàI | is a horse |
| m | mupippi | muβɪ́ppI | nose (nom) |
| n | mupippi | muβɪ́ppiA | nose (acc) |
| o | šïmïakka | šïmɪ́akkA | let it go (pret) |
| p | sïmïakkai | sïmɪ́AʰkaI | let go (pret) |
| q | tïššapï | tIʰšáɸI | rope (nom) |
| r | tïššapïa | tIʰšáβïA | rope (acc) |
| s | muššuipi | MUʰšúiɸI | moustache (nom) |
| t | muššuipia | MUʰšúiβìA | moustache (acc) |
| u | muttakka | MUʰtákkA | forehead (nom) |
| v | muttakkaa | MUʰtákkaA | forehead (acc) |
| w | appïikku | Aʰpɪ́ikkU | to fall asleep |
| x | paččaikkai | pAʰčáIʰkàI | to hang (as branch) |
| y | pikkakʷittïa | pIʰkáɣʷIʰtìa | “sore buttocks” (personal name, acc) |
| z | pattakkittui | pAʰtákkIʰtùI | to cause to burst |

In (12, i), the capital A at the end of each word in the "Phonetic" column indicates that every word final vowel is devoiced. The first vowel of the word is devoiced in (12f) and in all the ones beyond (12q). That's because in those examples the first vowel is both the weak member of a foot, and it precedes a geminate stop in the "Phonological" column. The examples in (12j) and (12r) constitute a minimal pair. The first vowel does not precede a geminate obstruent in (12j) and does not devoice; yet it does in (12r), so it devoices.

Vowels in non peripheral syllables devoice in (12p) and (12 x, y, z). Notice that in the attested examples of (12p) and (12x), the vowel that devoices is the second half of a tautosyllabic diphthong. In these cases as well, the vowel that devoices is a weak member of a foot and immediately precedes an underlying geminate obstruent. Except for word final devoicing, this is the only circumstance that triggers vocalic devoicing.

The geminate obstruent that triggers vowel devoicing always itself degeminates, and there is no other degemination in SP. The resulting "degeminated" geminate is realized as a sequence of an "untimbered" [h] followed by a singleton obstruent.

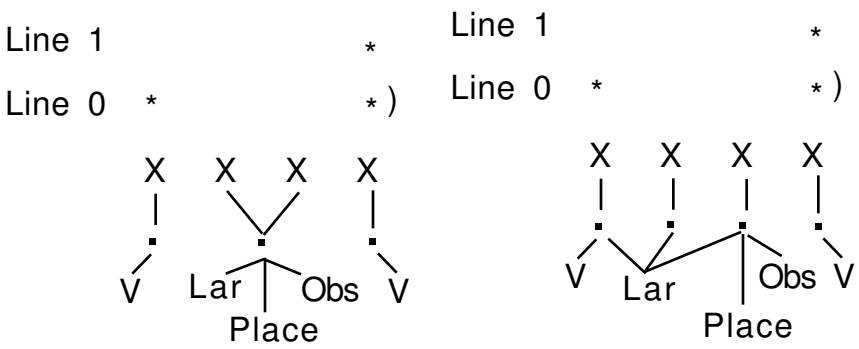
Now, what exactly is the environment in which the degemination and devoicing phenomenon takes place? We set aside for now word final devoicing. At first glance, it appears that unstressed vowels devoice if they precede a geminated obstruent. Consider, however, examples (12 o, w): In these cases, the penultimate vowel is in an odd position, and thus unstressed. Even though it also precedes a geminate obstruent, it does not devoice. Therefore, "unstressed" does not characterize the environment for devoicing. As shown in the next paragraph, the phrase "weak member of a metrical foot" correctly captures what is needed.

The penultimate vowel never devoices in SP, even if it is unstressed and precedes a geminate obstruent. Even if unstressed, the penultimate vowel is not a weak member of a foot because the vowel to its right does not project a mark onto line 0 of the metrical tier, because of a parameter setting in the Halle/Idsardi framework. Because the final vowel is not available to serve as the head of a foot, the penultimate vowel ends up unfooted when in an odd position. The penultimate vowel is always voiced: If it is in an even position, it bears stress. If it is in an odd position, it is not the weak member of a foot so does not undergo devoicing.[2]

It follows from the preceding that the presence of a devoiced vowel is a useful diagnostic for determining foot structure: If a (non final) vowel is unvoiced, it is the weak member of a foot. If a voiced vowel precedes a geminate obstruent, it is not the weak member of a foot (it is not necessarily the head, as we saw just above).

We can make a reasonable stab at specifying the input and output representations of the degemination/devoicing process, now that we know we need metrical structure. Again skipping a lot of argumentation, it seems reasonable to assume that (15) depicts plausible structures, staying within the Halle/Idsardi framework.

(15) Plausible input and output representations for degemination/devoicing.




Only the feature geometry changes in (15); the metrical structure and the number of segments remain constant. In the input, the [Laryngeal] and [Place] nodes are associated with one root, which is specified as [Obstruent]. This root is associated with the two timing slots that define the geminate. In the output, the [Laryngeal] node spreads over three segments: the weak vowel, the segment corresponding to what was the first half of the geminate, and, of course, the remaining obstruent. The [Place] node and root node, retaining the feature [Obstruent], remain only on what was the right half of the obstruent. Because the output segment corresponding to the first half of the input geminate is associated with only the laryngeal node, it emerges as an untimbered [h].

With this background, we now turn to our capstone example, (16):

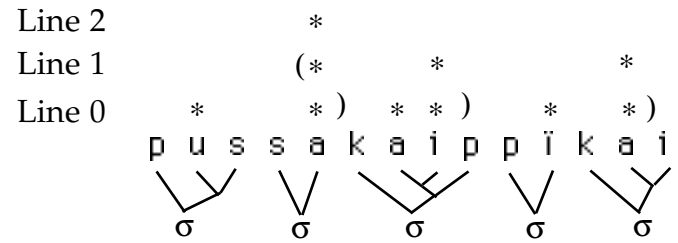
(16) Example showing that v́v differs from v́v. The tautosyllabic diphthong /-ai-/ precedes the geminate /p/.

(a) v́v = aì

pussakai- -ppïkai

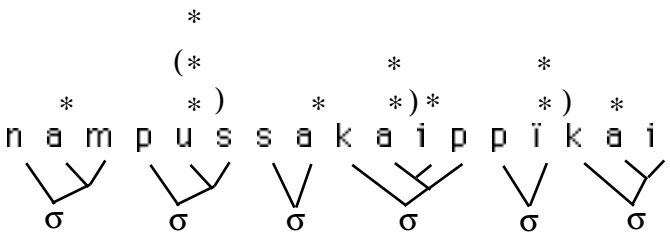
'to look for' remote past

[pUʰsáɣàìpːïɣàʰ]



(b) v̌v = ài

| | | |
|---|---|---|
| | | Line 2 |
| | | Line 1 |
| nam- | pussakaippïkai | Line 0 |
| incorporated noun (?) | as above | |




[nampússaɣàIʰpˋïaʰ]

The verbal stem meaning 'to look for' ends in /ai/ which, as we have seen, constitutes the nucleus of a single syllable. The suffix for 'remote past' begins with a geminate /pp/. In (16a), the vowel we are interested in attains status as head of foot, and does not devoice. In (16b), however, a monomoraic element has been prefixed onto the word, shifting the vowel count to the left by one. Now the stem final /i/ is assigned a role as a weak member of a foot, and it devoices. And in so doing, it presents a clear case of a violation of SI. Clearly, in SP v̌v and vv̌ sequences are linguistically distinct, as shown by their behavior before a geminate obstruent.

## 6. Conclusion

Using standard, relatively theory-neutral modes of argumentation for foot and syllable structures, I have shown that SP presents a clear case of a violation of SI. As mentioned before, Daniel Everett (1996) has made a similar argument for Banawà. His evidence, like the SP case, relies in part on phonotactics. He also adduced evidence from hypocoristics. SP buttresses the case with morpheme alternations, particularly the pattern of vowel shortening.

Hayes' (1996, 122) argues that "long" vowels in SP are two-vowel, disyllabic sequences at a stage of derivation where the rules of vocalic devoicing and stress apply. His argument rests on the observation that vocalic devoicing affects only the second half of a long vowel. To assume that the long vowel consists of two tautosyllabic segments would go "…against the characteristic 'inalterability' of long segments, … but follows straightforwardly if the long vowels are two-vowel sequences (hence disyllabic) at the stage where the rules apply."

It is not just long vowels that violate SI, but also diphthongs; therefore issues of 'inalterability' do not arise. And we have shown that the sequence /ai/ is clearly tautosyllabic, and it is implicated in the most spectacular violation of SI. Hayes' argument also posits an abstract stage of a derivation where each vowel is assigned to a separate syllable, presumably to be followed by a resyllabified stage. There is no evidence whatsoever that this earlier stage exists.

The literature has only a handful of examples where SI is violated. We have shown that SI violations are within the computational capacity of UG, but there must be some explanation as to why they are so rare.

It is reasonable to expect that it is highly marked for syllables to be misaligned with feet; perhaps alignment constraints apply, OT-like, to the timing tier. A constraint requiring that both edges of every foot be aligned with a syllable edge might be high

ranking in most languages that have been studied so far, but is violated in SP. Of course, this is very different from the questions how the structures on the various tiers come into being in the first place, and how they might be modified by other parts of UG.

Before concluding, it is of some interest to conjecture on how SP came to violate SI. Recall that Sapir speculated that singleton, intervocalic /s/ and nasals all dropped out between proto-Shoshonean and Southern Paiute. Maybe before this happened, there were no violations of SI. Then, after the consonants deleted, stress remained on the same vowels as before, but the preexisting syllabification algorithm incorporated the now adjacent vowels into the same syllable. This would explain the SP violations of SI as historical baggage.

It is worth emphasizing that this shows that UG must sanction grammars that have historical baggage and other productive processes that do not reflect a drive toward unmarked representations. For example, it is not obvious that the SP degemination/devoicing phenomena yield a phonetic representation that is less marked than the input, yet it is a highly productive aspect of the language.

I would like to end with further justification of the three dimensional array, plus a promissory note. First, the three dimensional representation is implicit in the OT literature; for example, constraints that align grammatical and phonological structures presumably assume that the grammatical and phonological information is represented on different planes. Furthermore, Halle and Vergnaud (1987) proposed that both Tiberian Hebrew and Yidiny require two metrical planes. This possibility has not been pursued much in the subsequent literature. If these and perhaps other examples were really to show that we need more than one metrical plane, then we would have much stronger evidence for a three-dimensional theory of representation. And now the promissory note -- a CUNY student, Nora Aion, and I argue in a forthcoming study that Tübatulabal, another Shoshonean language, requires two orthogonal metrical planes. This language has iterative vowel lengthening from left to right across the word, and iterative stress from right to left across the word. The vowel lengthening phenomenon is a relic from a historically earlier stage where there was left to right stress assignment, before the language adopted its current right to left stress system. This is readily analyzed in a three dimensional framework, with two metrical planes -- one for accounting for iterative lengthening, the other for stress. Another example of historical baggage playing a productive role in the phonology of a language!

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Notes:

1. I would like to thank two colleagues for their help on this paper, Professor Marcel den Dikken, and Professor Helen Cairns. Of course, I take full responsibility for any and all infelicities in this paper.

2. Sapir suggested that the penultimate vowel is exempt from devoicing because of a constraint against two voiceless vowels in contiguous syllables, suggesting that the specification "unstressed" be sufficient to describe the environment for the process to take place. The account in the text is superior, because it captures all the environments of (nonfinal) devoicing with a single statement.

Halle and Vergnaud (1987) and Hayes (1995) account for the fact that the penultimate vowel never devoices by giving it fixed stress. This is completely unnecessary in the analysis in this paper.