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Prosodic effects of segmental correspondence*

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1 Introduction

In this paper we investigate a class of misapplication effects arising in reduplication and copy epenthesis, specifically those relating to the assignment of phonological properties relating to prominence. We show that extensions of Correspondence Theory (McCarthy & Prince [M&P] 1995) can explain these effects, given a phonological grammar that contains the following properties (1-2):

(1)   A correspondence relation between surface segments, arising when multiple output segments correspond to a single input segment (as below).

$$/X_i/$$
$$[X'_i] \nearrow \quad \searrow [X''_i]$$
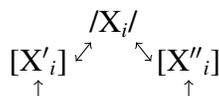
(2)   Faithfulness constraints that require identity between correspondents with respect to suprasegmental properties (i.e. IDENT[stress], etc.).

We show that a grammar with these properties can generate a range of effects, many of which have yet to receive satisfactory explanations in the literature.

2 Prosodic correspondence in reduplication

Since M&P 1995, Correspondence Theoretic approaches to reduplication have appealed to faithfulness between the Base (B) and the Reduplicant (R) to explain numerous properties of reduplication. For example, BR-correspondence has been invoked to account for "length transfer" effects (see Levin 1985, M&P 1988), where corresponding B and R vowels match in length (thus $[short]_R \leftrightarrow [short]_B$ or $[long]_R \leftrightarrow [long]_B$). Other than those involving length, BR-correspondence effects involving suprasegmental properties have not been very frequently reported. We discuss next one striking case found in Ngan'gityemerri (Reid 2011), where the drive for BR-identity induces misapplication of stress (see Zukoff 2015).

2.1 Stress matching in Ngan'gityemerri

In Ngan'gityemerri (Reid 2011), serial verbs are composed of an auxiliary stem plus a verbal stem. In the normal case, such a word has two and only two stresses: one on the leftmost syllable of the auxiliary stem, and one on the leftmost syllable of the verbal stem (3). To capture this we use the constraints in (4), ranked as in (5).

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(3)   Basic stress in the complex verb (examples from Reid: pp. 97-98)[1]
       a.   yé-nim=mì-wap-nyine   'She's married now'
       b.   wárra-ngiti=fì-pal-endi-pe   'They'll come back for me later'

(4)   a.   **STRESSL-STEM**: Assign one * for each stem (i.e. auxiliary and verbal
             stem) whose leftmost syllable does not bear a stress.

       b.   **ONESTRESS(complex verb)**: The complex verb (i.e. auxiliary stem
             and verbal stem) should have exactly one stress. Assign one * for each
             additional stress. (cf. CULMINATIVITY; Prince 1983)

(5)   Ranking: STRESSL-STEM ≫ ONESTRESS(complex verb)

There is only one case in which additional stresses arise: when the syllable at
the left edge of the verbal stem stands in BR-correspondence with another syllable.
When this occurs, both correspondents bear a stress (6). Note that this behavior
cannot be due to some more general desire for reduplicated forms to bear stress:
when both B and R are stem-medial, neither bears a stress (7).

(6)   Additional stresses (pp. 97-99; R is underlined, B+R in { })
       a.   wí-rr-ing-gu={dà-<u>dà</u>}   'They (dl.) are singing'
       b.   yé-mi-ngiti={<u>fì</u>-fìtyi}-pagu-pe   'Roll me some (smokes)!'
       c.   ngúdum={bàt-<u>bìt</u>}   '… and knocked it to the ground'

(7)   No additional stresses (a from p. 186[2], b from p. 98)
       a.   yé-rr-mi-gi=mì-{<u>fa</u>-fala}-pe   'Keep showing it!'
       b.   wá-n-ngi=fì-mi-{tyat-<u>it</u>}-tye   'They used to show me how to do it.'

The combined facts of (6) and (7) can be straightforwardly explained using BR-
faithfulness: if STRESSL-STEM requires a stress on either B or R, IDENT[stress]-
BR (defined in (8)) requires a stress on the other correspondent (9).[3]

(8)   **IDENT[stress]-BR**: Assign one * for each vowel in the reduplicant where
       the presence or absence of stress differs from the corresponding base vowel.

(9)   Additional stress with stem-initial BR: *yé-mi-ngiti=<u>fì</u>-fìtyi-pagu-pe* (6b)

ye...=<u>RED</u>-fityi...	STRESSL-STEM	ID[stress]-BR	ONESTRESS (complex verb)
☞ a. yé...=<u>fì</u>-fìtyi...			**
b. yé...=<u>fì</u>-fityi...		*!	*
c. yé...=<u>fi</u>-fityi...	*!		

(10)   No additional stress with stem-medial BR: *yé-rr-mi=mì-fa-<u>fa</u>la-pe* (7a)

ye...=mi-<u>RED</u>-fala...	STRESSL-STEM	ID[stress]-BR	ONESTRESS (complex verb)
a. yé...=mì-<u>fà</u>-fàla...			**!*
b. yé...=mi-<u>fà</u>-fàla...	*!		**
c. yé...=mì-<u>fà</u>-fala...		*!	**
☞ d. yé...=mì-<u>fa</u>-fala...			*

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[1]The symbol " = " indicates the stem-stem boundary; " - " indicates a morpheme boundary.

[2]Reid does not provide stress marking on the forms in Section 3 of his grammar. Stress marks in
example (7a) are inferred, based on Reid's detailed description of stress in Section 2.

[3]Additional effects of IDENT[stress]-BR are found in nominal reduplication (see Reid 2011:92).

Ngan'gityemerri shows us several important points. First, faithfulness constraints must be able to reference suprasegmental properties like stress. This is not surprising: IDENT[stress] constraints along the Input-Output faithfulness dimension are necessary for describing lexical stress systems (e.g. Kager 2012). Second, faithfulness constraints must be able to reference non-underlying (i.e. surface) properties: stress is fully predictable in Ngan'gityemerri, and therefore only a property of surface forms (on correspondence for surface properties, see Benua 1997, Steriade 2000, Albright 2006, Albright 2015). Finally, note that stress and featural identity are independent: the extra stress compelled by IDENT[stress]-BR is found even when the reduplicant imperfectly copies the base, as in *ngúdum*={*bàt-ḇìt*} (6c). This implies that surface correspondence is not (or not exclusively) driven by surface similarity, as in e.g. Rose & Walker (2004); we will revisit this issue in §4.

## 2.2   Extension: from reduplication to copy epenthesis

Most models that allow BR-correspondence assert that both the output base and the reduplicant simultaneously stand in correspondence with the input (M&P 1995, Spaelti 1997, Struijke 2000). These relations can be expressed as in (11):

(11)   Correspondence relations in reduplication (M&P's "Full Model")

$$\text{IR-Correspondence} \quad \overset{\text{/Input/}}{\underset{[\text{RED}] \quad [\text{Base}]}{\nearrow \nwarrow}} \quad \text{IB(/IO)-Correspondence}$$
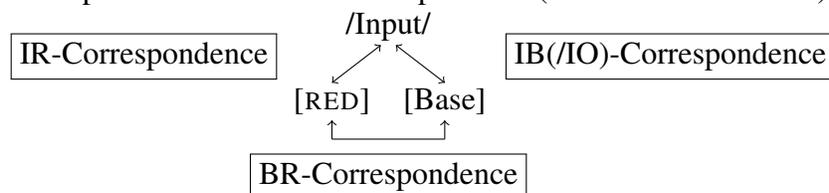
BR-Correspondence

If we assume that BR-correspondence in some sense exists *because* both B and R stand in correspondence with the same Input, the structural correspondence relations in (11) can be generalized: whenever two or more output segments stand in correspondence with the same input segment, by transitivity, they also stand in correspondence with each other (also Struijke 2000, McCarthy 2002).

(12)   Generalized multiple correspondence

$$\text{IO-Correspondence} \quad \overset{/X_i/}{\underset{[X'_i] \quad [X''_i]}{\nearrow \nwarrow}} \quad \text{IO-Correspondence}$$

Correspondence by transitivity
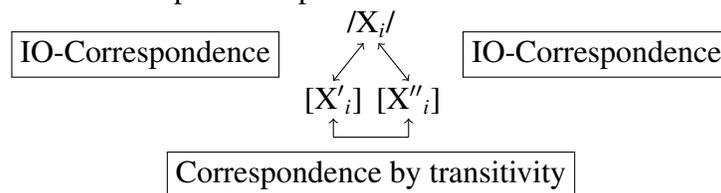
In addition to reduplication, we assert (*contra* Kawahara 2007) that copy epenthesis (distinct from default epenthesis) has this structure. Both output vowels – the copy and its featural host – correspond to a single input vowel, and therefore correspond with each other. We call the sort of correspondence that holds between these two vowels the Surface Correspondents (SC) relation (cf. Kitto & de Lacy 1999). We argue also that the grammar contains faithfulness constraints modulating the relationship between segments standing in SC-correspondence, just like any other correspondence relation. These constraints drive misapplication of stress and other prosodic properties in a number of cases of copy epenthesis, discussed below.

3   Copy epenthesis in Scottish Gaelic

To illustrate our assumptions about the representation of copy epenthesis, we turn to Scottish Gaelic. In Scottish Gaelic, heterorganic falling sonority clusters are broken up by epenthesis. The epenthetic vowel (underlined) is always identical to the vowel preceding it, modulo predictable effects of palatal agreement.

(13)   Copy epenthesis in Scottish Gaelic (Bosch & de Jong 1997:1-2)
  a. /arm/ → [ar<u>a</u>m] 'army'
  b. /ʃaɫv/ → [ʃaɫ<u>a</u>v] 'prosperity'
  c. /urxirʲ/ → [ur<u>u</u>xirʲ] 'a shot'
  d. /dɔrxɔ/ → [dɔr<u>ɔ</u>xɔ] 'dark'

The pattern in (13) is diagnostic of *copy* epenthesis, where an inserted vowel consistently resembles one of its neighbors. This process is distinct from *default* epenthesis, where an inserted vowel always takes on some particular default value (its exact realization potentially varying slightly by context). We argue that default and copy epenthesis have significantly different phonologically representations. Default epenthesis inserts material that has no relation to the underlying form: we take this to violate DEP (or DEP[feature]). Copy epenthesis, on the other hand, takes material that is present elsewhere in the underlying representation and causes it to additionally surface outside of its underlying location. We take this to violate INTEGRITY, and not DEP.[4] The constraints in (14), ranked as in (15), are necessary to generate copy epenthesis; an illustrative tableau follows in (16).[5]

(14)   Constraints for copy epenthesis
  a. ***BADCLUSTER**: Cover constraint for whatever triggers epenthesis.
  b. **INTEGRITY-IO**: One * for each input segment that stands in correspondence with multiple output segments.
  c. **DEP-IO**: One * for each output seg. lacking an input correspondent.

(15)   Ranking: *BADCLUSTER, DEP-IO ≫ INTEGRITY-IO

(16)   Copy epenthesis with short host vowels: /arm/ → [ar<u>a</u>m] (13a)

/arm/	DEP-IO	*BADCLUSTER	INTEGRITY-IO
a. arm		*!	
☞ b. a$_x$ra$_x$m			*
c. arəm	*!		

Notice that all forms with copy epenthesis in (13) have a short host.[6] When the cluster-type targeted by copy epenthesis occurs after a long vowel (or a diphthong), copy epenthesis is blocked, and the cluster is not repaired (17).

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[4]It is likely that some sort of DEP constraint is violated in copy epenthesis: perhaps it is DEP-*timing slot*. This constraint would be equally violated in default epenthesis.

[5]Steriade (1990), Hall (2003), and others have analyzed cases of copy epenthesis as gestural mistiming: the appearance of the copy vowel in words like [ar<u>a</u>m] is not due to the insertion of an additional timing slot, but rather movement of the tongue tip gesture within the gestural score. It is unclear how this analysis could be extended to account for the misapplication effects documented in this paper. The featural identity predicted by a gestural mistiming approach does not obviously extend to prosodic identity, as suprasegmental properties are controlled by independent articulators.

[6]We call the vowel surfacing in its expected location the "host", and the other vowel its "copy".

(17)   No copy epenthesis if the host vowel is long (Hammond *et al.* 2014:126)
   a.   /miːrvəlʲəx/   →   [miːrvəlʲəx]   'marvelous'
   b.   /duə̯lxəs/   →   [duə̯lxəs]   'tradition'
   c.   /niə̯lvər/   →   [niə̯lvər]   'cloudy'
   d.   /iːrmɛltʃ/   →   [iːrmɛltʃ]   'firmament'

When we assume the multiple-correspondence representation of copy epenthesis, this blocking effect can be analyzed simply as an *emergence of the unmarked* effect against long vowels. To see this, we need to introduce two additional constraints:

(18)   Length constraints for blocking in Scottish Gaelic
   a.   **IDENT[length]-IO**: One * for each pair of segments standing in IO correspondence that mismatch in mora count (/v/ ↔ [vː] or /vː/ ↔ [v]).
   b.   ***LONGV (*Vː)**: One * for each long vowel.

   When the would-be host vowel is long, length considerations interact to make copy epenthesis of *any* vowel, whether short or long, suboptimal. The fact that copying the vowel as a *long* vowel is not a possible repair shows us that *LONGV ≫ *BADCLUSTER: leaving a bad cluster intact is preferable to introducing another long vowel. Since the copy vowel would stand in IO-correspondence with an underlying long host, copying the vowel as a *short* vowel is dispreferred due to high-ranking IDENT[length]-IO. This is independently necessary to ensure that length is contrastive in the language. Scottish Gaelic's solution to this problem is to leave the bad cluster unrepaired (19). Our structural assumptions about copy epenthesis thus make the analysis of the blocking facts straightforward.[7]

(19)   Copy epenthesis blocked with long hosts: /iːrmɛltʃ/ → [iːrmɛltʃ] (17d)

/iːrmɛltʃ/	DEP-IO	ID[length]-IO	*Vː	*BADCLUSTER
☞ a. iːrmɛltʃ			*	*
b. iː$_x$riː$_x$mɛltʃ			**!	
c. iː$_x$ri$_x$mɛltʃ		*!	*	
d. iːrəmɛltʃ	*!			

   There is one additional interesting piece to this example. IDENT[length]-IO prevents altering the *categorical* length of vowels; but, upon investigation of the durational facts (presented by Bosch & de Jong 1997), it is evident that there is a sub-categorical *length matching* effect that emerges in cases of copy epenthesis: copy-host pairs match with respect to duration. In normal CV_1CV_2 words (i.e. where V_2 is *not* epenthetic), V_1 is longer than V_2. However, in words with copy epenthesis (i.e. where V_2 *is* epenthetic), the duration of V_1 and V_2 are about equal.[8] Put differently, V_1 is shorter in the epenthetic than the non-epenthetic context, and V_2 is longer in the epenthetic than the non-epenthetic context. The result is that V_1 and V_2 are durationally equivalent only when the sequence is a copy-host pair.

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[7]Candidate (19c) could also be ruled out by an IDENT[length] constraint on the SC-correspondence dimension. This result is therefore, in part, overdetermined.

[8]See Bosch & de Jong 1997:5-6 for figures 2-3 demonstrating this effect, as well as figures 4-5 for a similar pitch-matching effect. Space considerations prevent us from reproducing them here.

This length-matching effect goes well beyond anything that would be predicted by an analysis involving IO-correspondence alone. It can, however, be captured by our proposal regarding surface correspondence. If two surface segments that derive from a single underlying segment stand in correspondence with one another, they can become more similar through correspondence and faithfulness.[9]

4   Stress misapplication in Selayarese and Hocank

In this section, we show how the desire for suprasegmental identity among copy-host pairs induces misapplication in the assignment of prominence in two languages: Selayarese (§4.1) and Hocank (§4.2). In both cases, the precise nature of the prominence targeted by SC-faithfulness is somewhat ambiguous. For the sake of consistency and compatibility with the literature, we present them as stress.

4.1   Copy epenthesis in Selayarese

In Selayarese, stress normally falls on the penultimate syllable. As shown in (20), all stressed syllables are heavy: if the stressed syllable is open, the vowel lengthens (a-b); if the stressed syllable is closed (usually by a geminate, as here), the vowel is short (c). Vowel length is not contrastive; long vowels are only found under stress.

(20)   Penultimate stress in Selayarese (Mithun & Basri 1986: 219, 226)
   a.   kasúːᵐba   'dye for coloring clothes or cake'
   b.   sáːsa   'cut (grass)'
   c.   sássa   'wash'

We model this pattern with the constraints *LAPSER and NONFINALITY (Gordon 2002); these constraints together require that stress fall on the penult. For simplicity, we only entertain candidates where stressed syllables are heavy.

(21)   a.   ***LAPSER**: Assign one * if neither of the final two syllables are stressed.
        b.   **NONFINALITY**: Assign one * if the final syllable is stressed.

(22)   Default penultimate stress: [kasúːᵐba] (20a)

/kasuᵐba/	*LAPSER	NONFINALITY
a. káːsuᵐba	*!	
☞ b. kasúːᵐba		
c. kasuᵐbáː		*!

There is, however, a class of words that has exceptional antepenultimate stress. As is evident in (23), these words have certain properties in common. In all cases, the last two vowels are identical, they are separated by a coronal continuant (/s/, /r/, or /l/), and the final vowel present in the isolation form drops when a vowel-initial suffix is added (e.g. [hállasa] 'suffer' → [halláːs-i] 'make suffer').

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[9]The IDENT-SC framework, if permitted an IDENT constraint that can reference sub-categorical duration, provides a direct way to ensure that these vowels match in duration. However, arriving at the precise durational value we observe is not trivial. It is evident from Bosch & de Jong 1997 that both vowels in a copy-host pair are longer than normal unstressed vowels, but shorter than normal stressed vowels: descriptively, this seems to be a durational compromise. We leave a full analysis for future work, though we suspect that the answer may lie in details of phonetic implementation.

(23)   Antepenultimate stress in Selayarese (Mithun & Basri 1986: 237)
      a. bóːtolo 'bottle'   c. míntara   'tomorrow'
      b. túːlisi 'write'   d. kíːkiri   'metal file'

One possible analysis of these facts (as advocated in Mithun & Basri 1986) is that the word-final vowel is epenthetic,[10] and that epenthetic vowels are invisible for the purposes of stress assignment. Once we look at more data, however, it becomes clear that epenthetic vowels are not always invisible to stress. In the loanwords in (24) and (25), stress lands on the penult despite the presence of an epenthetic vowel (underlined) in the penult (24), or in both the antepenult and the final (25). In such words, default stress applies, showing that the epenthetic vowels "count" for stress.

(24)   Internal epenthesis in loanwords (Broselow 2001:3)[11]
      a. [karáːtu] 'card'   not *[káːratu]   (source: Indonesian [kártu])
      b. [surúːga] 'sugar' not *[súːruga] (source: Indonesian [súrga])

(25)   Internal and external epenthesis in loanwords (Broselow 2001:4)
      a. [solodéːre] 'weld'   not *[sóːlodere] (source: Ind. [sólder])
      b. [karatíːsi] 'ticket' not *[káːratisi] (source: Ind. [kárcis])

We propose that a drive for copy and host vowels to *agree in stress*[12] drives misapplication in the class of words with antepenultimate stress in (23) (see also Kitto & de Lacy 1999; other analyses include Piggott 1995, Alderete 1999, Broselow 2001). We formalize this with the constraint IDENT[stress]-SC, defined in (26):

(26)   **IDENT[stress]-SC**: Assign one * for each pair of vowels standing in SC-correspondence that do not have identical values for stress (i.e. [stressed] ↔ [unstressed] or [unstressed] ↔ [stressed]).

To derive misapplication of stress, both IDENT[stress]-SC and *CLASH (= *one * for every sequence of two adjacent stressed syllables*) must dominate *LAPSER. In (27) and the tableaux that follow, we analyze only the assignment of stress; the candidate set is limited to those outputs with epenthesis in the appropriate position.

(27)   Misapplication of stress to satisfy IDENT[stress]-SC: [túːlisi] (23b)

/tulis/	NONFIN	*CLASH	IDENT[stress]-SC	*LAPSER
☞ a. túːli$_x$si$_x$				*
b. tulíː$_x$si$_x$			*!	
c. tuli$_x$síː$_x$	*!		*	
d. tulíː$_x$síː$_x$	*!	*!		

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[10]Epenthesis is likely triggered by a desire to avoid a coda consonant with an independent place feature – a version of CODACONDITION (Ito 1986). See Broselow 2001 for related discussion.

[11]Some previous accounts of Selayarese stress (e.g. Piggott 1995, Kitto & de Lacy 1999) assume that epenthetic vowels do not lengthen under stress. While it's true that epenthetic vowels fail to lengthen when they precede the possessive suffix /-ku/ (e.g. [sahalákku] 'my profit'), outside of this specific environment, they lengthen just like underlying vowels (as in (24)); see Broselow 2001:22.

[12]An analysis in which the vowels agree in *length* is also possible. For reasons of space, we do not present this analysis, which is in all other ways virtually identical to that based on stress.

IDENT[stress]-SC does not lead to misapplication in cases like (24) and (25), because there is no permissible means to satisfy it. To explain the forms in (24) we must say that both NONFIN and *CLASH dominate IDENT[stress]-SC. Stressing the final syllable incurs a fatal violation of NONFIN, as in candidate (28a). Stressing both the copy and the host, as in candidate (28b), satisfies IDENT[stress]-SC, but fatally violates *CLASH. Stress therefore defaults to the penult, in order to satisfy *LAPSER (compare optimal candidate (28c) to losing candidate (28d)). The same interaction yields default penultimate stress in the double epenthesis forms in (25).

(28)   Default penultimate stress with medial epenthesis: [kará:tu] (24a)

/kartu/	NONFIN	*CLASH	ID[stress]-SC	*LAPSER
a. ka$_x$ra$_x$tú:	*!			
b. ká:$_x$rá:$_x$tu		*!		
☞ c. ka$_x$rá:$_x$tu			*	
d. ká:$_x$ra$_x$tu			*	*!

While the data is scarce, it appears as though default stress also applies when the copy-host pair comprises the second and third syllables of a four-syllable word: [poto$_x$ló$_x$-kku] 'my pencil', not *[pó:to$_x$lo$_x$-kku] (Mithun & Basri 1986: 231). This is the expected result if *EXTLAPSER (= *one* if none of the final three syllables are stressed*) dominates IDENT[stress]-SC. Given the ranking in (28), coupled with the high ranking of *EXTLAPSER, the only configuration where stress could misapply is when the single copy-host sequence is word-final, as in (23). And this is exactly where we see misapplication, i.e. antepenultimate stress.

Before moving on, we would like to consider the near-minimal[13] pair in (29). These forms both have final [uru] strings, but stress only misapplies in (29a).

(29)   Stress difference in a near-minimal pair (Mithun & Basri 1986: 217, 238)
        a.   Antepenultimate stress   já:guru   'to box, punch'
        b.   Penultimate stress   ka?mú:ru   'nose'

The near-minimal pair in (29) aside, a potential alternative proposal for the data discussed in this section might be that stress identity is enforced between all pairs of identical vowels spanning [r], [l], and [s]. This could easily be implemented in a framework allowing *similarity-driven* surface correspondence (i.e. Agreement By Correspondence, Rose & Walker 2004), in which featurally similar segments are forced to correspond, and then become *more* similar through the activity of faithfulness constraints governing relations among corresponding output segments. This style of analysis, however, would wrongly predict misapplication in both (29a) and (29b), as both contain final [uru] strings. The fact that we see misapplication in only (29b) shows that this correspondence relation isn't sensitive to surface similarity. Recall also that, in Ngan'gityemerri, stress-matching occurs even when the vowels are not featurally identical. Therefore, we hold that the type of correspondence observed in Selayarese stress-matching is established when multiple output

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[13]There is also at least one perfect minimal pair of this sort: [sá:hala] 'profit' vs. [sahá:la] 'sea cucumber' (Mithun & Basri 1986: 239-40), but the accidental identity between the first vowel and the other vowels somewhat obscures the point to be made here.

segments correspond with the same input segment. Surface similarity itself plays no role here.

4.2   Copy epenthesis in Hocank

Hocank (also known as Winnebago) also has a process of copy epenthesis, and, as in Selayarese, it can cause stress to misapply. This seemingly opaque interaction between stress and epenthesis has drawn much attention in the literature (e.g. Miner 1979 *et seq.*, Hale & White Eagle 1980, Halle & Vergnaud 1987, Alderete 1995, Hayes 1995, Hall 2003), but thoroughly analyzing the facts has proven difficult. In this subsection, we show that, by making a slight emendation to the interpretation of the data (motivated by early sources and evidence from pitch-tracking), the pattern admits of a simple analysis in the IDENT-SC framework.

Even putting aside its interaction with epenthesis, the Hocank stress system is fairly complex. It is essentially a trimoraic left-edge window system, with stress attracted to heavy nuclei, subject to various conditions on nucleus-internal prominence relations. These issues of weight do not crucially interact with the epenthesis facts, so, for simplicity, we will discuss only words with exclusively light nuclei, such that there is no divergence between syllable count and mora count. Abstracting away from the weight effects, the basic Hocank stress pattern is illustrated in (30) (all data from Miner 1989 unless noted). This pattern can be described with the constraints in (31), whose activity is demonstrated in (32).

(30)   Description of basic Hocank stress
- a. If the word has three or more syllables, stress the post-peninitial.
  4σ: *wamąnų́ke* 'thief', *wanįǧį́g-ra* 'the bird'
  3σ: *wanįgį́k* 'bird', *hipirák* 'belt'
- b. If the word contains only two syllables, stress the peninitial.[14]
  2σ: *hiwą́x* 'to ask' *hosgáč* 'playground'

(31)   Constraints for post-peninitial stress:
- a. **NONINITIALITY**: Assign one * if stress falls on the first syllable of the word (cf. Garrett's (1999) UPBEAT).
- b. **EXTENDEDNONINITIALITY**: Assign one * if stress falls on one of the first two syllables of the word.
- c. ***EXTENDEDLAPSELEFT**: Assign one * if no stress falls within the first three syllables of the word.

(32)   3rd syllable (post-peninitial) stress in 3+ syllable words

/wamąnųke/	NONINIT	EXTNONINIT	*EXTLAPSEL
a. wámąnųke	*!	*!	
b. wamą́nųke		*!	
☞ c. wamąnų́ke			
d. wamąnųké			*!

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[14]Words of only a single light syllable appear to be unattested. Monosyllabic words always consist of a heavy syllable, e.g. [zíː] 'yellow, orange'. This is likely due to a minimal word requirement.

In Hocank, *voiceless obstruent* + *sonorant* clusters are broken up by epenthetic copy vowels. This is traditionally referred to as "Dorsey's Law" (DL). Some illustrative examples are provided in (33).

(33)   Examples of Dorsey's Law epenthesis (copy vowel is underlined)
     a.   /kre/   →   [k_ere]   'to leave'
     b.   /šroš/   →   [š_oroš]   'deep'

When a word contains a DL sequence in certain positions, *stress misapplies*. We argue that this is a result of undominated IDENT[stress]-SC. In the table in (34), we compare words of identical shapes that differ in whether or not (and where) they include a DL sequence (bracketed). Note that we assert that, when one member of a DL sequence bears stress, so does the other. This is not what most recent accounts assume, but there is strong evidence in favor of this view.[15]

(34)   Stress in DL vs. non-DL words (forms and glosses from Miner 1989)[16]

Word shape	No epenthesis	Word with DL sequence (in [ ])	
$\sigma_1\sigma_2$	$\sigma_1\acute{\sigma}_2$ ex. *hiwáx*	$[\acute{\sigma}_1\acute{\sigma}_2]$ ex. [*kéré*]	(←/**kre**/)
$\sigma_1\sigma_2\sigma_3$	$\sigma_1\sigma_2\acute{\sigma}_3$ ex. *hipirák*	$[\sigma_1\sigma_2]\acute{\sigma}_3$ ex. [*xere*]*hí* $\sigma_1[\acute{\sigma}_2\acute{\sigma}_3]$ ex. *hi*[*pérés*]	(← /**xr**ehi/) (← /hi**pr**es/)
$\sigma_1\sigma_2\sigma_3\sigma_4$	$\sigma_1\sigma_2\acute{\sigma}_3\sigma_4$ ex. *wamąnúke*	$[\sigma_1\sigma_2]\acute{\sigma}_3\sigma_4$ ex. [*para*]*ǧúčge* $\sigma_1[\sigma_2\sigma_3]\acute{\sigma}_4$ ex. *hi*[*kuru*]*ní* $\sigma_1\sigma_2[\acute{\sigma}_3\acute{\sigma}_4]$ ex. *hiru*[*píní*] $[\sigma_1\sigma_2][\acute{\sigma}_3\acute{\sigma}_4]$ ex. [*kere*][*páną́*]	(← / **pr**aǧųčge/) (← /hi**kr**uni̜/) (← /hiru**pn**i̜/) (← **kr**epną/)
$\sigma_1\sigma_2\sigma_3\sigma_4\sigma_5$	$\sigma_1\sigma_2\acute{\sigma}_3\sigma_4\sigma_5$ ex. *hokiwároke*	$\sigma_1[\sigma_2\sigma_3][\acute{\sigma}_4\acute{\sigma}_5]$ ex. *wa*[*kiri*][*párás*]	(← /wa**kripr**as/)

While there are multiple patterns among DL forms, the major points can be illustrated by comparing the words of four syllables. Notice that, in (35), which stress pattern we find depends on the position of the DL sequence. The different patterns result from the fact that there are two ways to satisfy IDENT[stress]-SC:

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[15]In all work on Hocank prior to Hale & White Eagle 1980, there is some acknowledgment of prominence on both members of a stressed DL sequence. Susman (1943) writes (p. 13) that "secondary stress seems to attach equally to both syllables", and Miner 1979 transcribes stress on both copy and host vowels. The early interpretation that both syllables bear stress is supported by pitch-tracking data (Hall 2003:172-3). Pitch is the major (perhaps only) acoustic correlate of stress in Hocank, and in DL sequences – but not other disyllabic sequences – both vowels bear high pitch.

[16]*hokiwároke* 'swing (n.)' is from Miner 1979. It is transcribed with a final secondary stress, which we omit here.

by stressing *neither* the copy nor the host, or by stressing *both* the copy and the host. When the DL sequence occupies $[\sigma_1\sigma_2]$ (35b), nothing prevents stress from applying normally. Thus, (35b) shows normal application, just like non-DL (35a).

(35) Stress in 4σ words[17]

DL location	Stress pattern	Example	Stress application type	
a. n/a	$\sigma_1\sigma_2\acute{\sigma}_3\sigma_4$	*wamąnų́ke*	Normal:	$\acute{\sigma}_3$
b. $[\sigma_1\sigma_2]$	$[\sigma_1\sigma_2]\acute{\sigma}_3\sigma_4$	*[pạra]ǧų́čge*	Normal:	$\acute{\sigma}_3$
c. $[\sigma_2\sigma_3]$	$\sigma_1[\sigma_2\sigma_3]\acute{\sigma}_4$	*hi[kụru]nį́*	Misapplication:	$\acute{\sigma}_4$
d. $[\sigma_3\sigma_4]$	$\sigma_1\sigma_2[\acute{\sigma}_3\acute{\sigma}_4]$	*hiru[pį́nį́]*	Misapplication:	$\acute{\sigma}_3$ & $\acute{\sigma}_4$

However, when the DL sequence includes σ_3 (35c-d), misapplication results. Because IDENT[stress]-SC is undominated, applying normal σ_3 stress triggers the need for stress on the other member of the DL sequence. Hocank displays two responses to this problem, driven by an interaction between the metrical constraints and the two means of satisfying IDENT[stress]-SC.

One response is to satisfy IDENT[stress]-SC by stressing neither DL vowel. This is found in words of the shape $\sigma_1[\sigma_2\sigma_3]\sigma_4$ (35c). In this case, normal application of stress on σ_3 would compel a stress on σ_2, due to IDENT[stress]-SC. Stressing σ_2, however, would cause a violation of EXTNONINITIALITY. The fact that fourth-syllable stress is preferred in this context reveals that EXTNONINITIALITY $\gg$ *EXTLAPSEL, as illustrated in (36).

(36) Misapplication: 4th syllable stress with DL in $[\sigma_2\sigma_3]$ (*hi[kụru]nį́*)

/hikrunį/	ID[stress]-SC	EXTNONINIT	*EXTLAPSEL
a. hikú̱$_x$rú$_x$nį̱		*!	
☞ b. hikụ̱$_x$ru$_x$nį́			*
c. hikụ̱$_x$rú$_x$nį̱	*!		

The other response is to satisfy IDENT[stress]-SC by stressing both DL vowels. This is found in words of the shape $\sigma_1\sigma_2[\acute{\sigma}_3\acute{\sigma}_4]$ (35d). Normal application of stress on σ_3 compels stress on σ_4, due to undominated IDENT[stress]-SC. While an alternative way to satisfy IDENT[stress]-SC would be to stress only σ_2, this is ruled out by the ranking EXTNONINITIALITY $\gg$ *CLASH, illustrated in (37).

(37) Misapplication: 3rd & 4th syllable stress with DL in $[\sigma_3\sigma_4]$ (*hiru[pį́nį́]*)

/hirupnį/	ID[stress]-SC	EXTNONINIT	*CLASH
☞ a. hirupį́$_x$nį́$_x$			*
b. hirúpį̱$_x$nį̱$_x$		*!	
c. hirupį́$_x$nį̱$_x$	*!		

The two types of misapplication that we see in four-syllable words share a common cause: IDENT[stress]-SC must *always* be satisfied, even at the expense of

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[17]In both (35c) and (35d), the forms with misapplication end in *nį*; this is not crucial. Examples of other forms not ending in *nį* that show these same misapplication patterns are *hi[kọro]hó* 'to prepare' and *hačą[ké̱ré]* 'with difficulty.'

*CLASH. In addition, EXTNONINITIALITY must be satisfied whenever possible; this can come at the expense of either *EXTLAPSEL (as in (36)) or *CLASH (as in (37)). The other types of patterns found in (34) are consistent with the rankings demonstrated in four syllable words, and in addition reveal several other interactions among the metrical constraints and IDENT[stress]-SC. The rest of the arguments can be discovered through comparison of optimal outputs $ké_xré_x$ (38) and $hipé_xré_xs$ (39) to other potential candidates. See (40) for a summary of the analysis.

(38)   1st & 2nd syllable stress in 2σ DL-only words ([$kére$])

/kre/	IDENT[stress]-SC	NONINIT	*CLASH
☞ a. $ké_xré_x$		*	*
b. $ké_xre_x$	*!	*	
c. $ke_xré_x$	*!		

(39)   2nd & 3rd syllable stress in 3σ words with DL in [$\sigma_2\sigma_3$] (hi[$pérés$])

/hipres/	ID[stress]-SC	NONINIT	EXTNONINIT	*CLASH
☞ a. $hipé_xré_xs$			*	*
b. $hípe_xre_xs$		*!	*	
c. $hipe_xré_xs$	*!			

(40)   Stress rankings (transitive arguments omitted)[18]

IDENT[stress]-SC

1 ↙   2 ↘

NONINITIALITY   EXTNONINITIALITY

3 4 ↘   5 ↘

*CLASH   *EXTLAPSEL
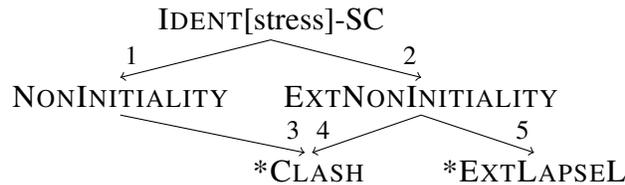
^{1} $[ké_xré_x] \succ$ *$[ke_xré_x]$ ^{4} $[hirupí_xní_x] \succ$ *$[hirúpi_xni_x]$

^{2} $[hipé_xré_xs] \succ$ *$[hipe_xré_xs]$ ^{5} $[hiku_xru_xní] \succ$ *$[hikú_xrú_xni]$

^{3} $[hipé_xré_xs] \succ$ *$[hípe_xre_xs]$

We note, finally, that, in addition to stress, the behavior of vowel length/duration gives additional indication that copy vowels and their hosts must be identical in derived, i.e. predictable, features in Hocank. Descriptions of the phonetics of DL sequences (e.g. Susman 1943:9-10, Miner 1979:26) often note that both vowels in the DL sequence are overly short.[19] This can be analyzed as *backcopying* of length (i.e. shortness) due to SC-correspondence. It's not implausible that Hocank requires epenthetic vowels to be very short (on this see Steriade 2001). Host vowels, then, become overly short in order to match their copy. Similar IDENT-SC effects can also be seen for vowel nasality, which is predictable in some contexts (see Miner 1989). These effects provide further support for SC-correspondence in Hocank.

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[18]To ensure that some stress surfaces in [kéré] (as opposed to the alternative [kere], where there are no stresses at all), we also assume that ONESTRESS is undominated; in other words, it's required that all phonological words in Hocank have some stress.

[19]The total duration of the sequence, however, lies somewhere in between the durations of one long and two short syllables (Susman 1943:10, via Hall 2003:149).

In sum, Hocank simultaneously displays several properties found independently in Ngan'gityemerri (§2.1), Scottish Gaelic (§3), and Selayarese (§4.1). As seen in Ngan'gityemerri, stress identity between surface correspondents can force the placement of an additional stress, even at the expense of creating a clash. As in Selayarese, the need for stress identity between surface correspondents can force misapplication of stress (i.e. exclusive placement outside of the normal stress domain), when metrical constraints permit. And finally, like in Scottish Gaelic, copy-host pairs exhibit a need for durational identity; in Hocank, this leads to an abnormally short duration of both the copy and host vowels.

5   Summary and conclusion

Throughout this paper, we have argued that the two properties in (41) are part of the phonological grammar. We have shown that a grammar with these two properties can account for a diverse range of effects, as summarized in (42).

(41)   Necessary properties of the phonological grammar
   a. The existence of a correspondence relation between surface segments, arising under particular structural configurations (of which copy epenthesis is one, and reduplication is another).
   b. Faithfulness constraints that require identity (between surface correspondents) for suprasegmental properties like stress.

(42)   Summary of effects observed[20,21]

Language	Process	Effect
Ngan'gityemerri	Reduplication	stress misapplication
Scottish Gaelic	Copy epenthesis	duration & pitch matching
Selayarese	Copy epenthesis	stress misapplication
Hocank	Copy epenthesis	stress misapplication; duration, nasality & pitch matching

These effects provide strong evidence that copy epenthesis must involve *correspondence*, as argued for by Kitto & de Lacy (1999), and not (or not exclusively) *spreading*, as argued for by Kawahara (2007). Kawahara argues that Kitto & de Lacy's (1999) correspondence-based analysis of copy epenthesis overgenerates: it predicts identity between copy-host pairs for prosodic properties, a class of effects that Kawahara's survey of copy epenthesis does not uncover. But we have shown

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[20]Sources for the languages listed: Reid 2011 for Ngan'gityemerri; Bosch & de Jong 1997 and Hammond *et al.* 2014 for Scottish Gaelic; Mithun & Basri 1986 and Broselow 2001 for Selayarese; and Miner 1979, Miner 1989 for Hocank.

[21]We find a stress-matching pattern virtually identical to that of Selayarese in Tahitian (Bickmore 1995): stress is normally penultimate, e.g. [teáta] 'theater' (p. 413); however, when identical vowels separated by a glottal stop appear in the final two syllables (V_iʔV_i#), stress retracts to the antepenult, e.g. [mútaʔa] 'first' (p. 422). If we assume that identical translaryngeal vowels correspond for stress in Tahitian, then an active IDENT[stress]-SC constraint would generate this pattern.

that these effects are in fact attested, so the overgeneration argument is moot. More to the point, it is difficult to imagine how an analysis that *only* makes use of spreading could account for the effects observed here. Their existence is therefore an argument strongly in favor of the correspondence-based analysis developed here.

In addition, the proposed structural similarity between copy epenthesis and reduplication (anticipated by Kitto & de Lacy) helps us understand why the two processes display many of the same effects. We have shown that similar suprasegmental identity effects occur in both processes; if copy epenthesis and reduplication both involve multiple correspondence, their similarity in this respect is predicted by our proposal, and this is indeed what is attested.

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