

Levels vs. Domains

The Case of Kashaya Vowel Length

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Background

In the ordered-rule approach to phonology which has until recently characterized most generative work in the field, there can be many **intermediate stages** in a derivation. A classic case from English (cf. Kiparsky 1982):

- | | | | |
|-----|----|-------------------------------------|-----------------------------------|
| (1) | a. | <i>basic form</i> | pró ^é st _V |
| | b. | <i>V → N conversion, new stress</i> | pró ^t èst _N |
| | c. | <i>N → V conversion</i> | pró ^t èst _V |

The intermediate stage (b) provides a simple account for the location of stress in the final form (c). In some cases, however, intermediate stages lead to complications in the analysis, such as requiring pseudo ‘**look-ahead**’ devices.

For example, a standard assumption in derivational prosodic phonology is that lower-level constituents are created before higher ones: e.g. syllables, then feet, then the word. In metrical phonology, this **bottom-up** construction means feet are created before the word layer (by the End Rule, picking out the leftmost or rightmost foot). But Hayes (1995) and others have argued that sometimes there is motivation for **top-down** parsing: apply the End Rule, then construct feet so that the head of a foot is under the higher grid mark (in accordance with the Continuous Column Constraint).

We can contrast the treatment of **initial light-heavy** in two languages which both have quantity-sensitive trochees built from left to right: the difference follows from top-down versus bottom-up parsing.

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|---|-----------------|-----------------------|---|----|-------|------|---|---|---|---|-------|---|----|-------|------------------|--|---|---|---|---|---|---|----|-----------------|------|---|---|---|---|-------|---|----|-----------------|-----------------------|
| <p>(2) a. <u>Malayalam</u>:
bottom-up parsing</p> <p style="margin-left: 20px;"><i>i. Footing</i></p> <table style="margin-left: 40px; border: none;"> <tr> <td style="text-align: center;">~</td> <td style="text-align: center;">(-)</td> <td style="text-align: center;">~</td> </tr> <tr> <td style="text-align: center;">pa</td> <td style="text-align: center;">r̄ a:</td> <td style="text-align: center;">t̄ i</td> </tr> </table> <p style="margin-left: 20px;"><i>ii. End Rule</i></p> <table style="margin-left: 40px; border: none;"> <tr> <td style="text-align: center;">(</td> <td style="text-align: center;">x</td> <td style="text-align: center;">)</td> </tr> <tr> <td style="text-align: center;">~</td> <td style="text-align: center;">(-)</td> <td style="text-align: center;">~</td> </tr> <tr> <td style="text-align: center;">pa</td> <td style="text-align: center;">r̄ á:</td> <td style="text-align: center;">t̄ i ‘complaint’</td> </tr> </table> | ~ | (-) | ~ | pa | r̄ a: | t̄ i | (| x |) | ~ | (-) | ~ | pa | r̄ á: | t̄ i ‘complaint’ | <p>b. <u>Cahuilla</u> (v[?] rime is heavy):
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| ~ | (-) | ~ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| pa | r̄ a: | t̄ i | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (| x |) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ~ | (-) | ~ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| pa | r̄ á: | t̄ i ‘complaint’ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (| x |) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ~ | - | ~ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| su | ka [?] | t̄ i | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (| x |) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ~ | (-) | ~ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| sú | kà [?] | t̄ i ‘the deer (OBJ)’ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

In Cahuilla, the need to have a foot underneath the x placed by the End Rule forces creation of a degenerate (~) foot so that the initial syllable is stressed.

A **surface-oriented** approach such as Optimality Theory (Prince and Smolensky 1993) eliminates such inconsistencies, and that is one of its primary advantages. For example, the Malayalam/Cahuilla contrast can be analyzed using surface constraints only, such as the following.

- | | | | |
|-----|----|--------|---|
| (3) | a. | FTBIN | A foot must contain two moras or two syllables. |
| | b. | ALIGNL | The main stress must be at the left edge of the word. |

The two logical **rankings** of these constraints give us the two languages.

- | | | | |
|-----|----|----------------|---|
| (4) | a. | FTBIN » ALIGNL | <i>Do not stress the initial syllable if that would require a degenerate foot.</i>
= Malayalam |
| | b. | ALIGNL » FTBIN | <i>Create a degenerate foot in order to achieve initial-syllable stress.</i>
= Cahuilla |

An important example of an intermediate stage is the **level** of lexical phonology, which captures a relationship between sets of phonological and morphological rules. I illustrate with data from Manam (Lichtenberk 1983), in which **stress clash is prohibited within a root but not elsewhere**. This leads to the stress pattern $C\acute{V}C.C\grave{V}.C\acute{V}$ internal to a root (5) but $C\grave{V}C.C\acute{V}.C\acute{V}$ elsewhere (6).

- (5) a. $\acute{e}mbe\text{?}i$ 'sacred flute'
 b. $\acute{o}\eta\text{?}au$ 'Onkau' (*name*)
- (6) a. $ar\grave{o}-n-t\acute{u}\text{?}a$ ($*ar\acute{o}ntu\text{?}a$) 'right in front of you'
 b. $s\grave{a}god\grave{e}-n-t\acute{i}na$ ($*s\grave{a}god\acute{e}ntina$) 'you are really well-mannered'

In a **lexical phonology model** (e.g. Kiparsky 1982), the root pattern suggests application of footing to the root alone, which avoids clash; but later footing, after suffixation and in a different level, permits clash.

- (7) a. *Root stress* ($\acute{e}mbe\text{?}i$) ($\acute{a}ro$)
 b. *Suffixation* — ($\acute{a}ro$)-n-tu?a
 c. *Refooting* — a(r\grave{o}n)(t\acute{u}\text{?}a)

While it is possible to incorporate levels directly into an OT approach (e.g. McCarthy and Prince 1993a), such a move **undermines the essential surface orientation** of the theory. The lack of levels in a strictly parallel version of OT might then be seen as a disadvantage of this approach. Buckley (1995a,b) proposes '**constraint domains**' which capture similar generalizations to levels by delimiting substrings of the surface representation which are subject to different constraint rankings. In Manam:

- (8) { root } { suffixes }

If **stress is assigned only once**, the otiose first stage of footing in (7) can be eliminated entirely. The root pattern is expressed as a **constraint on stress which holds only within the root domain**. A bit schematically (see Buckley 1995b for details):

- (9) *CLASH^{rt} Adjacent stressed syllables are not permitted. *Holds of the root only.*
 ALIGNR Align the right edge of the word with a foot.

(10)

{embe?i} _{rt}	*CLASH ^{rt}	ALIGNR
a. $\acute{e}mbe\text{?}i$		*
b. $(\acute{e}m)(b\acute{e}\text{?}i)$	*!	

(11)

{aro} _{rt} {n-tu?a} _{suf}	*CLASH ^{rt}	ALIGNR
a. $a(r\acute{o}ntu)\text{?}a$		*!
b. $a(r\grave{o}n)(t\acute{u}\text{?}a)$		

The clashing feet in (11b) are ignored because the clash $(r\grave{o}n)(t\acute{u}\text{?}a)$ is not within the root {aro}.

Cyclic effects like the conversion in (1) are the subject of considerable current work in Correspondence Theory (e.g. McCarthy and Prince 1994, 1995; Benua 1995; McCarthy 1995; Kenstowicz 1995; cf. Burzio 1994). Essentially, $pr\acute{o}t\grave{e}st_V$ has the stress it does because it is morphologically related to $pr\acute{o}t\grave{e}st_N$, not because it is derived from it.

I argue that domains are not only a **viable** reinterpretation of levels, but in fact are **superior** because they are able to capture generalizations which elude stepwise derivations. Specifically, the blocking of three processes in Kashaya, a Pomoan language of Northern California, which would alter vowel length in a particular set of suffixes can be captured in the domains account by a **single constraint**, but in lexical phonology the similarity must remain a coincidence.

The three processes in question are those termed by Buckley (1994) **Iambic Lengthening, Foot Flipping, and Final Shortening**; I discuss them in that order.

Iambic Lengthening

Kashaya builds iambs from left to right. The main (only) stress is normally on the first foot. **Iambic Lengthening** (=IL) yields a long vowel in the strong branch of an iamb.

- (12) a. **kel**-aloq^w-iç--i → (kelá:) (loqo:) çi 'look back up!'
 b. **kel**-mul-ad-uced--u → (kél:) (mula:) (duce:) du 'keep peering around'
 c. **mo**-mul-ad-uced--u → (momú:) (ladu:) (cedu) 'keep running around'

Buckley (1994) proposes five levels in a lexical phonology framework. There is **no lengthening** when the vowel heading the syllable belongs to a level 4 or 5 suffix (even if that is the main stress); the root is shown in bold, and all suffixes following the double hyphen are level 4 or 5.

- (13) a. **š**i--p^hila → (šip^hī)la 'if [it] happens'
 b. **mo**-mac-ed--ela → (momá:) (cedē)la 'I keep running in there'
 c. **hoṭ**^h-ala--šuw-em → (hoṭ^há:) (lašū) (wem) 'it would warm [us] up'

In this approach, the derivation requires **several stages**: first the lengthening suffixes are added to the root; then IL applies; and then the non-lengthening suffixes are added. After the second round of morphology, IL does not reapply. Specifically, Lengthening applies to the output of level 3 morphology, but then turns off and does not apply in levels 4 and 5.

- (14) a. MORPHOLOGY, level 3 mo + mac + ed
 b. Phonology (with Lengthening) (moma:) ce <d>
 c. MORPHOLOGY, level 5 (moma:) ced + ela
 d. Phonology (no Lengthening) (moma:) (cede) la

In a **domains** analysis, the double hyphen delimits two constraint domains, call them 1 and 2. (A complete account of the phonology may require more subtle division into domains.) **Non-lengthening suffixes** uniformly occur to the right of those which permit IL, so the domain of IL is a substring at the left side of the word. Schematically, this can be thought of in either of the following two ways: more descriptively (a) or as a translation of the levels approach (b).

- (15) a. { root + lengthening suffixes }₁ { nonlengthening suffixes }₂
 b. { root + level 2 + level 3 }₁ { level 4 + level 5 }₂

More specifically, if we do not appeal to *momaced* as an **intermediate** representation, we must refer to it as a **substring** of the surface representation within which IL occurs (cf. also Inkelas 1989, Inkelas and Orgun 1995). Below, within {...}₁ IL occurs, within {...}₂ it does not.


- (16) a. Input with domains shown {momaced}₁{ela}₂
 b. Output with feet (momá:)(cedē)(la)

The basic **effect of IL** is to achieve a perfect or canonical iamb, which consists of a light (and unstressed) syllable followed by a heavy (and possibly stressed) syllable (cf. Hayes 1985, 1995). Using constraints in a domains analysis, I posit the following constraint on Asymmetry within the foot.

- (17) ASYM In a branching iamb, the strong branch must be heavy.

Here I simply assume that the right **foot structure** is generated by proper ranking of constraints such as ALIGN, PARSESYL, and FTBIN; see Buckley (1995c) for complete analysis, including motivation for the presence of degenerate feet as shown below. ASYM determines the **internal composition** of those feet.

(18)

{keladuced} ₁ {u} ₂	ASYM
a. (kelá) (duce) (du)	*!*
b. (kelá:) (duce) (du)	*!
c.  (kelá:) (duce:) (du)	

IL must be prevented in the non-lengthening domain (cf. Urbanczyk 1995: 512, McCarthy 1995: 43).


(19) Q-IDENT The quantity of each input segment must be identical to its output quantity.

The **difference between lengthening and non-lengthening suffixes** is quite simply a matter of which constraint wins: ASYM or Q-IDENT. Since the winner differs across the two domains, there must be a different constraint ranking in those domains. Q-IDENT^{1}, which evaluates only segments in the lengthening domain C1, is ranked below ASYM; while Q-IDENT^{2}, for the non-lengthening domain C2, dominates ASYM to prevent IL.

(20) Q-IDENT^{2} » ASYM » Q-IDENT^{1}

The UR, with domains labeled, is shown in the upper left corner of the tableau.

(21)

{momaced} ₁ {ela} ₂	Q-IDENT ^{2}	ASYM	Q-IDENT ^{1}
a. (moma) (cede) la		**!	
b.  (moma:) (cede) la		*	*
c. (moma:) (cede:) la	*!		*

Not only is Q-IDENT^{1} low-ranked relative to ASYM, in fact it never plays any role in choosing candidates. Any form that Q-IDENT^{1} might favor is ruled out by an alignment constraints, which dominates ASYM and therefore necessarily Q-IDENT^{1}. (Every long vowel leads to a new foot and adds violations of ALIGN.) As noted by Buckley (1995a), an alternative to the view that a constraint such as Q-IDENT exists in two domain-specific forms is that there is only one constraint, but (in this case) it is ignored in C1. The important point is that violations within C1 never matter, whether this is treated as low ranking of a domain-particularized constraint, or by completely ignoring the violations. Thus I generally omit Q-IDENT^{1} from tableaux, as potential *CLASH^{suf} was omitted for Manam.

In sum, domains provide a rather straightforward reinterpretation of levels in a surface-oriented framework, avoiding complications of intermediate stages such as otiose footing and ad hoc extrasyllabicity (as in (14); see Buckley 1995a).

Foot Flipping

A remarkable indication of the pressure in Kashaya for iambic rhythm is found in Foot Flipping. Putting aside its formulation (which is, in fact, much more principled using constraints: see Buckley 1995c), it has the effect of changing an underlying ‘anti-iamb’ C_vvC_v, **flipping the vowel lengths** in the two syllables to create the perfect iamb C_vC_vv.

(22) a. **di:ć**-aq^w-ić--i → (dića:)(qoćí) ‘take a message out!’
 b. **qa:**-cid--u → (qaci:)(dú) ‘keep leaving’


In addition to the flipping of vowel lengths, the stress falls on the second foot, rather than on the first one as is normally the case in Kashaya. See Buckley (1995c) for an account in Correspondence Theory.

Foot Flipping, like Lengthening, **fails to apply if it would result in a long vowel within domain 2**, a fact which in OT can be attributed directly to the same constraint Q-IDENT.

(23) a. **di:ć**--eti → (di:)(ćetí) ‘although (he) tells’
 *(diće:)(tí)
 b. **qa:**--mela → (qa:)(melá) ‘I left’
 *(qame:)(lá)

In the OT analysis, the **high-ranking status of Q-IDENT^{2}** accounts for both facts: IL and Foot Flipping both introduce a long vowel, and Q-IDENT^{2} ensures that this not occur in C2.

(24)

{qa:} ₁ {mela} ₂	Q-IDENT ^{2}	ASYM
a.  (qa:)(melá)		*
b. (qame:)(lá)	*!	

The explanation of the correlation is transparent in the constraint-based analysis: in both cases, creation of a long vowel in C2 is blocked by Q-IDENT. The special status of C2 is stipulated for a **single constraint**,

which by itself accounts for the lack of **both processes**. Such an explanation is not possible in the ordered-rule approach, and this fact constitutes a powerful argument against it.

With **levels** the best we might do is to turn off Foot Flipping at the same point, i.e. after level 3 (cf. (14)), though even then the similarity would be a coincidence.

- (25) a. MORPHOLOGY, level 3 $\acute{q}a:$ + cid $\acute{q}a:$
 b. Phonology (with Flipping) $(\acute{q}aci:)$ <d> $(\acute{q}a:)$
 c. MORPHOLOGY, level 5 $(\acute{q}aci:)$ d + u $(\acute{q}a:)$ + mela
 d. Phonology (no Flipping) $(\acute{q}aci:)$ (du) $(\acute{q}a:)$ (mela)

That is, this move provides no explanation as to **why** this correlation should obtain, and it is predicted that a similar language might have the same rules in different levels. This prediction is dubious, since both processes result in the same canonical iamb.

The similarity is further obscured by the fact that the rule of Foot Flipping cannot turn off after level 3. Rather, it has to be active throughout the lexical phonology, to avoid a true look-ahead device: this is necessary because whether or not Foot Flipping actually occurs depends on the overall syllable structure of the word, and this depends on suffixes added in levels 4 and 5. Therefore it is only the rule of “CV Adjunction”, which feeds Foot Flipping by creating an anti-iamb (CV:CV) from nonbranching (CV:), that is inactive after level 3. See Buckley (1994, 1995c) for discussion.

Final Shortening

The third process is Final Shortening. When a long vowel belonging to a verb root ends up in word-final position, as **when a vocalic suffix is elided, the root vowel becomes short**.

- (26) a. du-ki:--i → duki ‘scratch it with your fingernail!’
 b. hi-sa:--i → hiša ‘break!’
 c. qa:--i → qa ‘leave!’

There is a late verbal suffix -e:, however, which **surfaces with its length intact**.


- (27) a. miku:ṭ-ad--e: → mikuṭa:de: ‘keep humming’
 b. nohp^ho--t^hi-mi-mi-ya-e: → nohp^hot^himimiye: ‘did not live long ago’
 c. do-ht-ibic--t^h-e: → dohtibi^ht^he: ‘didn’t raise hand’

In a lexical phonology approach, Buckley (1994) proposed that this level 5 suffix has a special prosodic status such that it is **outside the prosodic word**, and thus does not undergo **word-final shortening**.

- (28) [[mikuṭa:d]_w e:]_φ


In the **domains** approach, however, nothing special needs to be said. The suffix -e: is independently known to be **located in domain 2** — it occurs to the right of all other domain 2 suffixes — so its underlying length is automatically protected by Q-IDENT^[2].

(29)

{miku:ṭad} ₁ {e:} ₂	Q-IDENT ^[2]	*V:] _w
a.  mikuṭa:de:		*
b. mikuṭa:de	*!	

Elision is effected by a set of constraints, most importantly ONSET. Of course, since a root vowel is located in domain 1, it is unprotected by Q-IDENT^[2], and is shortened.

(30)

{q̣a:} ₁ {i} ₂	ONSET	Q-IDENT ^[2]	*V:] _w	Q-IDENT ^[1]
a. q̣a:i	*!			
b. q̣a:			*!	
c.  q̣a				*

The deletion of the final /i/ is not a violation of Q-IDENT^[2], since identity constraints hold only when the relevant segment is actually present in both the input and output (McCarthy and Prince 1995). What

(30b,c) do violate isMAX, which normally prevents deletion of segments but in Kashaya is ranked below ONSET (as well as below DEP, which prevents insertion of a default onset consonant).

Conclusion

The constraint-domains approach offers a completely unified account for these three cases of blocking — a single high-ranking constraint, Q-IDENT, that holds strongly only within C-domain 2. A levels-based approach, on the other hand, must give quite distinct analyses of the three cases. There has already been considerable evidence adduced in favor of a phonology organized around constraints rather than rules. The contrast presented here shows that even though constraints can be fit into a level-ordered framework, a better framework is one which takes seriously the surface orientation of Optimality Theory and replaces levels with constraint domains.

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