

Colored Containment and the typology of INTERFACE constraints: a case study from lexical accent systems

Anthi Revithiadou/ University of the Aegean
revithiadou@rhodes.aegean.gr

Abstract: In this paper, we take a fresh look at morpho-accentual processes that carry a heavy lexical baggage and crucially call upon the assistance of interface constraints. First, we propose a theory of enriched representations. More specifically, we extend Goldrick's (1998, 2000) TURBIDITY THEORY to lexical accentuation and show that the revised model offers promising insights for the representation of lexical accents, especially those realized outside the sponsoring morpheme, as well as for the understanding of locality effects in their distribution. Second, based on Van Oostendorp's (2004) COLORED CONTAINMENT model, we propose a principled and more restrictive typology of interface constraints than INDEXED FAITHFULNESS. In the CC model, phonology is allotted limited access to morphological information. As a result, only a specific type of faithfulness constraints can refer to the morphology-phonology mapping. Markedness constraints do not regulate the relation between morphological structure and prosodic form, therefore they can never refer to (aspects of) the interface. Third, we show that CONSISTENCY OF EXPONENCE (McCarthy and Prince 1993ab) imposes a restriction on 'Freedom of Analysis': a lexical accent is taken to constitute part of the lexical representation of a morpheme and as such it cannot be changed by GEN. This has important consequences for accent migration phenomena.

Both CC and TT draw a distinction between unpronounced but, nevertheless, underlyingly present structure, and pronounced structure. In this sense, the theoretical coverage of the paper relies heavily on the notion of (intra- and inter-level) 'visibility'.

1. Introduction

➤ One way of explaining how morphological (and lexical) information is coded in phonology is by means of INDEXED/INTERFACE constraints.¹ Critics of the INTERFACE CONSTRAINT (IC) approach, however, call attention to the fact that indexing is not limited to faithfulness constraints alone (Inkelas and Zoll 2003) and, moreover, constraints can be indexed practically for anything (see Anttila 2002 for a somewhat crude implementation of IC to stem-final vowel alternations in Finnish morphology).

➤ Empirical scope of this paper: morpho-accentual processes. More specifically, lexical stress in Greek, Russian and Thompson Salish.

☒ In this paper, we claim that Van Oostendorp's (2004) COLORED CONTAINMENT (CC) model provides a principled basis for the formulation of ICs and offers the necessary

¹ Anttila (2002) states that these are mainly faithfulness constraints, but they can also be markedness constraints, which are indexed to refer to specific morphological elements, e.g. individual morphemes or lexemes (Hammond 1995; Russell 1995), lexical strata, e.g. native vs. foreign (Fukazawa *et al.* 1998; Itô and Mester 1999), roots vs. affixes (McCarthy and Prince 1995; Alderete 1999), affix classes (Benua 1995, 1998), word categories, e.g. nouns vs. other categories (Smith 1997), or structural positions such as morphological heads vs. non-heads (Revithiadou 1999).

theoretical coverage to account for a wide range of morpho-accentual processes which crucially call upon ICs.

- A related issue when dealing with lexical stress is the representation of lexical accents.
- ☒ Goldrick's (1998, 2000) TURBIDITY THEORY (TT) offers promising insights for the representation of lexical accents, especially those realized outside their sponsors, as well as for the understanding of locality effects in their distribution.
- Both CC and TT rely on the notion of intra- and inter-level 'visibility': they draw a distinction between unpronounced but, nevertheless, underlyingly present structure and pronounced structure.

2. Colored Containment: the basics

In the classical version of Optimality Theory (OT, Prince and Smolensky 1993), GEN is restricted by CONSISTENCY OF EXPONENCE (CoE) (McCarthy and Prince 1993ab):

- (1) No changes in the exponence of a phonologically-specified morpheme are permitted.

This means that "the phonological specifications of a morpheme (segments, moras, or whatever) cannot be affected by GEN" (McCarthy and Prince 1993a:22). CoE implies that phonology enjoys a certain amount of 'visibility' to morphological structure and, therefore, can distinguish between elements of different morphological affiliation or no morphological affiliation at all, e.g. epenthetic material.

Classic OT also endorses CONTAINMENT (Prince and Smolensky 1993):

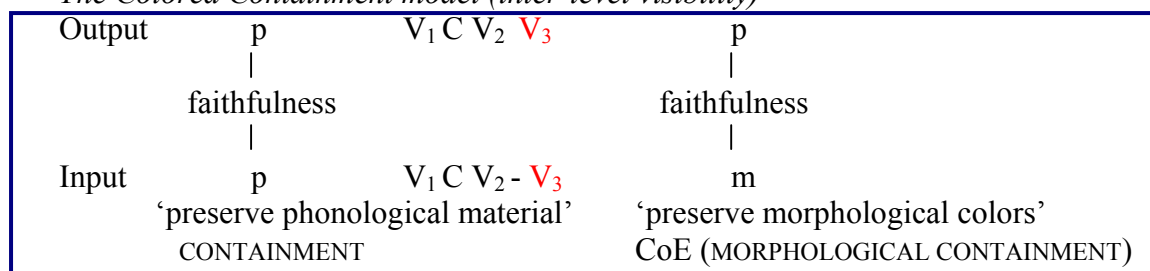
- (2) No element may be literally removed from the input form. The input is contained in every candidate form.

Van Oostendorp (2004) proposes that CoE and CONTAINMENT should be integrated again into the OT grammar. He visualizes the different morphological affiliation of phonological elements in terms of different colors. For instance in (3), V_1 is morphologically affiliated to the root (blue color) whereas V_2 is affiliated to the suffix (red color).

- (3) $CV_1C - V_2$

The most important aspect of COLORED CONTAINMENT (CC), as this model is called, is that it allows the morphological affiliation of phonological elements to be 'visible' in the surface structure. This visibility is crucial in the morphology-phonology interface.²

² Because of visibility, CC offers new ways to accounting for certain types of DERIVED ENVIRONMENT EFFECTS and OPACITY (see Van Oostendorp 2005; Van Oostendorp and Revithiadou 2005).

(4) *The Colored Containment model (inter-level visibility)*

- ✓ Question: Which aspects of morphology are *visible* to phonology?
- ☑ Answer: Different morphological colors (due to CoE)
But there is more, as we will see in a while...

3. Lexical accent systems: the data

3.1. Greek and Russian

Greek is a bounded trochaic system; the scope of primary stress is limited to the last three syllables of the word. Syllable structure lacks distinctions of phonological weight. Representative examples from the inflected nominal system are given in (5) and (6):

(5) *masculine nouns in -os (NOM.SG), -u (GEN.SG)*

a.	ánthropos	anθrópu	‘man’
b.	klívanos	klívanu	‘kiln’
c.	fantáros	fantáru	‘soldier’
d.	servitóros	servitóru	‘waiter’
e.	uranós	uranú	‘sky’

(6) *feminine nouns in -a (NOM.SG), -on (GEN.PL)*

a.	thálasa	thalasón	‘sea’
b.	γόνδoла	γόνδolon	‘gondola’
c.	stafíða	stafíðon	‘raisin’
d.	thiyatéra	thiyatéron	‘daughter’
e.	ayorá	ayorón	‘market’

Description of the facts: In the examples in (5), stress is located on any of the three positions allowed by the window. The examples *anθropos*, *klivanos*, *fantaros*, *uranos* are morphologically equivalent but differ in stress location. Moreover, in examples like (5a) stress shifts from the antepenultimate syllable in nominative singular to the penultimate one in genitive. A similar alternation is witnessed in (6a), with the difference that here stress shifts from the antepenultimate to the ultimate syllable. In general, pairs such as (5a-b) and (6a-b) have antepenultimate stress in the nominative form but not in the genitive.

- ☑ Lexical prespecification of roots and suffixes
- three accentual classes of roots:
 - accentless, e.g. /anθrop-/
 - accented, e.g. /klívan-/ , /fantár-/

- post-accenting roots, e.g. / $\text{uran}^{\wedge}$ -, / $\text{a}\gamma\text{or}^{\wedge}$ -/³
- three accentual classes of suffixes:
 - accentless, e.g. /-os/
 - accented, e.g. /-ón/
 - pre-accenting, e.g. /- $\wedge$ u/

	ACCENTLESS	ACCENTED	POST-ACCENTED	PRE-ACCENTED
ROOTS	anθrop-, θalas-	klívan-, servitór- θiyatér-, stafíð-	uran $\wedge$ -, aγor $\wedge$ -	
INFL. SUFFIXES	-os, -a	-ón		- $\wedge$ u

Table 1. Accentual properties of morphemes in Greek

A non-lexically pre-specified root will be stressed by the language-specific DEFAULT algorithm (i.e. APU for Greek) when combined with an accentless suffix; it will lose, however, stress from an inherently accented suffix.

Elaborate prosodic structures arise when morphemes with inherent accentual properties meet in the same word. Due to CULMINATIVITY⁴ only one accent must prevail.

- in *aγorón* (6e) both root and suffix accent strive towards final stress
- in *klívanu* (accented root + pre-accenting suffix) and in *uraní* (post-accenting root + pre-accenting suffix) there is an accentual conflict.

☒ Result: Root accent prevails.

Stress in Russian is unbounded and its position cannot be predicted on the basis of the phonological properties of the word nor on the basis of syllable structure.⁵

(7) *neuter nouns in -o (NOM.SG), -a (NOM.PL)*

- | | | | |
|----|---------|---------|----------|
| a. | zérkalo | zerkalá | ‘mirror’ |
| b. | práviló | právila | ‘rule’ |
| c. | bolóto | bolóta | ‘swamp’ |

(8) *feminine nouns in -a (NOM.SG), -y (NOM.PL)*

- | | | | |
|----|-----------|-----------|--------------|
| a. | skovorodá | skóvorody | ‘frying pan’ |
| b. | rabóta | rabóty | ‘work’ |
| c. | gospožá | gospoží | ‘lady’ |

	ACCENTLESS	ACCENTED	POST-ACCENTED
ROOTS	zerkal-, skovorod-	právil-, bolót-, rabót-	gospož $\wedge$ -
INFL. SUFFIXES	-o, -y/í	-á	

Table 2. Accentual properties of morphemes in Russian

In (9), nouns from Greek formed with the diminutive/pejorative suffix *-ak(-os)* are listed. This suffix can be combined with a nominal root of various accentual properties; the root can

³ The symbol ‘ $\wedge$ ’ is used to indicate that the accent is placed on a syllable outside the sponsoring morpheme. It precedes pre-accenting morphemes, e.g. /- $\wedge$ σ/, and follows post-accenting ones, e.g. /σ $\wedge$ -/.

⁴ CULMINATIVITY (Alderete 1999): Every prosodic word has exactly one head.

⁵ The primary sources for Russian are Halle (1973), Melvold (1990) and a small corpus compiled by the author with the assistance of informants and dictionaries. The following dictionaries were consulted: *Rückläufiges Wörterbuch der Russischen Sprache der Gegenwart* (1965), *The Concise Oxford Russian Dictionary* (1996).

be either accentless (9a), accented on the last syllable (9b), or post-accenting (9c). All forms are given in genitive singular which, as we have seen so far, is pre-accenting. In (10), analogous examples from Russian are given but here the inflectional suffix is accented. In all cases, *stress is on the accented derivational suffix*.⁶

- (9) *derived words: accented suffix -ak-os (masc)*
- | | | | |
|----|------------|---|------------------------|
| a. | ageláku | /agel-ák- [^] u/ | ‘little angel-GEN.SG’ |
| b. | papayaláku | /papayál-ák- [^] u/ | ‘little parrot-GEN.SG’ |
| c. | misθáku | /misθ [^] -ák- [^] u/ | ‘small salary-GEN.SG’ |
- (10) *derived words: accented suffix -ast-a (fem)*
- | | | | |
|----|-----------|-----------------------------|--------------------------|
| a. | borodásta | /borod-ást-á/ | ‘heavily bearded-NOM.SG’ |
| b. | gorlásta | /górl-ást-á/ | ‘loud-mouthed-NOM.SG’ |
| c. | jazykásta | /jazyk [^] -ást-á/ | ‘sharp-tongued-NOM.SG’ |

☒ Summary: Greek and Russian stress algorithm:

DerSuff Accent » Root Accent » InflSuff Accent » Default

3.2. Thompson Salish

In Thompson, stress is not limited to any particular edge of the word, as indicated by examples such as *héy=sk'iʔ-(e)-Ø-s* ‘gradually stop the music’ (Thompson and Thompson 1996:79), *ʔ'əq'am-t-és* ‘he preaches to them’ (Thompson and Thompson 1992:32). Thompson and Thompson (1992:21) claim that “stress manifests itself as a complex of loudness, force and pitch differences.”^{7, 8}

At first sight, Thompson gives the impression of a conflicting directionality stress system of the type: “Stress the leftmost full vowel; or else, the rightmost schwa”. The examples are from the Thompson and Thompson 1996 dictionary (abbreviated as Th).

⁶ Revithiadou (1999, ch. 4) explains why an analysis based on lexical strata is not preferable for the Greek and Russian stress facts.

⁷ Thompson Salish phonology in a nutshell: There is a general tendency unstressed vowels to drop and those that do not to convert to /ə/, e.g. *ʔ'əq'am-t-és* > *ʔ'q'am-t-és* ‘he preaches to them’, *k'wɪnex=éʔc'iʔ* > *k'wɪnex=éʔc'iʔ* ‘how many carcasses?’ (Thompson and Thompson 1992: 32). /ə/, however, has a phonemic status as well. This is indicated by the fact that it can bear a lexical accent, e.g. *mɛcəkʷ* ‘blackcap fruit’, *ʔestwǎlle* ‘(brush) is cleared away’ (Thompson and Thompson 1992: 20). Vowel loss causes cluster coalescence and other segmental processes. (See Revithiadou 1999, ch. 5 and references cited therein.)

⁸ Thompson Salish morphology in a nutshell: The constructions cited here serve as the predicate of the clause, and the lexical suffix corresponds to one of the arguments of the verb. More specifically, the lexical suffix corresponds to the object of the transitive predicate or to an oblique nominal such as locative or instrument. Often an independent nominal occurs in the same sentence with the predicate, which further specifies or extends the meaning of the lexical suffix. There are also reasons to believe that lexical suffixes can be coreferential with an independent nominal or pronominal of the same or of a previous clause. In other words, lexical suffixes exhibit the basic properties of noun incorporation. The only difference with real noun incorporation is that the lexical suffix is a bound and not a free-standing element, which always appears to be attached to a root. Carlson (1990) has argued that lexical suffixes originated as nominals that commonly occurred as the second element of compounds but they were phonologically reduced and ended up as bound forms. From this viewpoint, they can be regarded as incorporated nouns that have lost their status as free-standing nominals. (See Revithiadou 1999, ch. 5 and references cited therein for details.)

(11) *edge-oriented stress as default in Thompson*leftmost full vowel

- a. p'áq'wɛł (cf. n/p'áq'wɛł=qín) 'scaffold' (Th 252)
 b. n/páw'=ymx^w /paw'=uym'x^w/ 'the ground is frozen' (Th 228)
 c. q^wúł=xn /q^wuł=xən/ 'get a blister on foot' (Th 301)
 d. məł'q'^w-p=áqs /məł'q'^w-əp=aqs/ 'dislocate a joint' (Th 198)
 e. mək^wʔ=ús-m /mək^wʔ=us-əm/ 'cover one's face' (Th 197)
 f. kəł=áqs-xi-t-e /kəł=aqs-xi-t-e/ 'disconnect his end' (Th 89)

(12) rightmost schwa

- g. q'əłx^w-ə́m 'curl (s.t.)' (Th 278)
 h. cək=xə́n 'get foot chopped or cut' (Th 23)

However, the stress situation is slightly more perplexed since Roots and LexSuff can carry inherent accentual properties, as suggested by the following group of words:

(13) *one accented morpheme*accented root + accentless lexical suffix

- a. k^wén=cin 'take (s.o.'s) food'
 √grasp=mouth, food (/k^wén-/ /cin/) (Th 115)
 Cf. transitive k^wén-xi-t-Ø-es 'catch (s.t.) for s.o.' (Th 115)
 form √grasp-INDIR-TR-3O-3S (/k^wén-/)
 b. píx=n'i 'lay protective covering over s.t.'
 √lay-parallel=on top (/píx-/ /en'ih/) (Th 241)

accentless root + accented lexical suffix

- c. qayt=qín 'reach top'
 √reach=top (/qayt-/ /qín/)
 d. qayt=íkn 'go gradually along ridge to the very top'
 √reach=ridge (/qayt-/ /íkn'/) (Th 265)

post-accenting root + accentless lexical suffix

- e. q^win=cin 'talk back (to s.o.)'
 √talk=mouth (/q^win^-/ /cin/) (Th 296)
 Cf. transitive q^win-ə́m 'serve as spokesman' (Th 295)
 form √talk-MIDDLE (/q^win^-/)
 ʔes/q^win-s-t-sém-es 's.o. spoke to me' (Th 295)
 STAT/√talk-CAUS-TR-1sgO-3S (/q^win^-/)
 f. s/weʔx=íl'e 'adopted child'
 NOM/√be=offspring (/weʔx^-/ /il'eh/) (Th 373)

(14) *two accented morphemes*accented root + accented lexical suffix

- a. píx=qn 'lay boards on top (of s.t.)'
 √lay-parallel=top (/píx-/ /qín/) (Th 241)

- b. $k^w\acute{e}n=kn'$ 'grab s.o. by the back (of clothes)'
 $\sqrt{\text{grasp}}=\text{back}$ ($/k^w\acute{e}n-/$, $/=ikn'/$) (Th 115)

post-accenting root + accented lexical suffix

- c. $q^win=ikn'$ 'talks (about s.o.) behind (his) back'
 $\sqrt{\text{talk}}=\text{back}$ ($/q^win^--/$, $/=ikn'/$) (Th 296)
- d. $\acute{y}ac=qín-m$ 'tie s.t. up at top'
 $\sqrt{\text{tangle}}=\text{top-MDL}$ ($/\acute{y}ac^--/$, $/=qín'/$) (Th 471)

	ACCENTLESS	ACCENTED	POST-ACCENTED
ROOTS	paw' - $c'\acute{a}q'$ -	$k^w\acute{e}n$ - $píx$ -	$q^win^$ - $we?x^$ -
LEX. SUFFIXES	$=cin$ $=en'ih$	$=qín$ $=ikn'$	

Table 3. Accentual properties of morphemes in Thompson Salish

☒ Summary: Thompson stress algorithm:

Root-Accent » Accent » Leftmost-V » Rightmost-ə

4. The representation of lexical accents

There is little consensus in the literature on the exact nature of lexical stress. There are two mainstream approaches:

- *representational* approaches that attribute exceptional stress to differences in the lexical specification of certain morphemes (Halle and Vergnaud 1987; Idsardi 1992; Halle and Idsardi 1995; Inkelas 1994/1999; McCarthy and Prince 1995; McCarthy 1995/2000; Alderete 1999 *et seq.*; Revithiadou 1999).
- *non-representational* approaches that account for exceptional stress by means of co-grammars (Pater 1994; Revithiadou 1997), word/morpheme specific constraints (Hammond 1995) or different parameter-settings (Tsay 1990).

The drawbacks of non-representational approaches are discussed in Revithiadou (1999). Here we adopt a representational approach to accounting for exceptional/lexical stress.

✓ Question: If exceptionality is encoded in the lexical representation of morphemes, then how is it represented? In other words, *what is a lexical accent?*

Previous proposals:

- ☒ Inkelas (1994/1999) based on Turkish: trochaic foot lexically affiliated with a morpheme (PARSE guarantees that it overrides default final stress). Building on that, McCarthy (1995) proposes to make faithfulness sensitive to foot-internal positions occupied by segmental material. Thus, given the appropriate ranking, morphemes with foot final segmental anchors, e.g. $/(Iy\acute{o}r)/$ (PROGR), will retain their lexical stress.

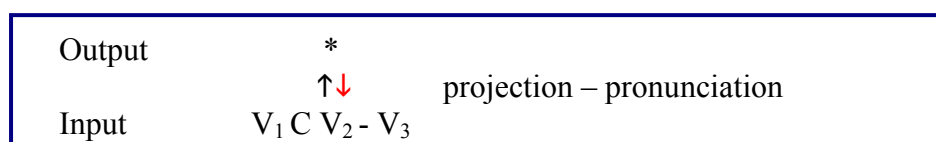
☒ A better model for the representation of lexical accents is needed.

4.1. The ‘turbidity theory’ of accents

Goldrick (1998, 2000) proposes a richer representational device which allows for *turbid* structures. This means that “the output of the grammar will contain unpronounced material which ‘can’ influence the surface – the portion of the output which is pronounced.” (Goldrick 2000:2)

- *Turbidity Theory* (TT): Two relations hold between a vowel and a lexical accent (or, in general, any autosegmental feature sponsored by the V):
 - projection (up-arrow ↗): an abstract, structural relationship holding between the vowel and the LA
 - pronunciation (down-arrow ↘): an output relation that holds between the LA and the vowel and describes the output realization of structure

(19) *TT representations (intra-level visibility)*



The unmarked case is for projection and pronunciation to match ($\mathfrak{R}^{LA}_V$). (High ranking RECIPROCITY¹⁰ guarantees that.) In this case, we have a transparent, non-turbid relation. *Structural Harmony* constraints, however, can override this pressure and, as a result turbid, opaque relations can arise (see Goldrick 1998, 2000 for examples).

☒ An implementation of TT to lexical accent representation translates as follows:

(a) *accented morphemes* (transparent, non-turbid relation between V and LA): The LA is projected and pronounced by the same V, e.g. V_2 .

(20)

*	accented morpheme (root)
↑↓	
$V_1 C V_2 - V_3$	

(21)

/σó-σ/	σός	<i>Greek</i>
/fantár-os/	fantáros	‘soldier-NOM.SG’
/rabót-y/	rabóty	‘work-NOM.PL’

☒ The accent is projected by a specific V of a morpheme and is pronounced on that same vowel (or another V of the same morpheme, as we will see shortly).

(b) *post-/pre-accented morphemes* (covert, turbid relation between V and LA): The LA is floating, hence not bound by projection to any specific vowel of the sponsoring morpheme.

¹⁰ RECIPROCITY: If Y projects to X , then X must pronounce Y (Goldrick 2000:3).

- (22) a. * post-accenting morpheme (root)

$V_1 C V_2 - V_3$

- b. * pre-accenting morpheme (suffix)

$V_1 C V_2 - V_3$

- (23) a. $/\sigma\sigma^\wedge - \sigma/$ $\sigma\sigma\acute{\sigma}$ *Russian*
 $/\text{gospo}\acute{z}^\wedge - \acute{a}/$ $\text{gospo}\acute{z}\acute{a}$ ‘lady-NOM.SG’
- b. $/\sigma\sigma - \sigma^\wedge/$ $\sigma\acute{\sigma}\sigma$ *Greek*
 $/\text{an}\theta\text{rop} - \acute{u}/$ $\text{an}\theta\acute{\text{r}}\text{o}\text{pu}$ ‘man-GEN.SG’

☒ Where exactly the LA will be pronounced is decided by the constraint-system.

☒ A restriction on ‘Freedom of Analysis’:¹¹

- (24) Projection lines are inalterable by GEN.

Projection lines represent the lexical state of affairs, that is, they are part of the lexical representation of a morpheme. Therefore, in conformity with CoE, they cannot be changed by GEN. The same applies to floating LAs; a projection line cannot be inserted in this case. Only pronunciation lines are susceptible to the function GEN. Thus, the representation in (26) can never be a legitimate member of the candidate set for the input in (25a) nor for the input in (25b).

- (25) *inputs*

a. * b. *
 $\uparrow$
 $V_1 V_2 V_3 - V_4$ $V_1 V_2 V_3 - V_4$

- (26) *candidate output (pronunciation line is not included)*

*
 $\uparrow$
 $V_1 V_2 V_3 V_4$

☒ This will prove to be crucial in the treatment of accent shifts.

- (27) *projection – pronunciation constraints for lexical accents* (based on Goldrick 1998, 2000):

a. $V \nrightarrow LA$: A vowel V of morpheme/color M must project its lexical accent LA at the phonological level.

b. $LA \nrightarrow$: Lexical accents must be pronounced.

c. $RECIPROcity^{LA}_V (\mathfrak{R}^{LA}_V)$: If a vowel V of morpheme/color M projects a lexical accent LA on the phonological level, then the lexical accent LA must be pronounced on the vowel V of morpheme/color M at the phonological level.

¹¹ I wish to thank Marc van Oostendorp for pointing out this restriction to me.

(28) an example: accented root – accentless suffix

$\check{V}_1 V_2 -, -V_3$	$V \nearrow LA$	$RECIP^{LA}_V$	$LA \searrow$
* $\uparrow \downarrow$ a. $V_1 V_2 - V_3$			
* $\uparrow \searrow$ b. $V_1 V_2 - V_3$		*!	
* $\uparrow$ c. $V_1 V_2 - V_3$			*!

5. A CC analysis of lexical accentuation

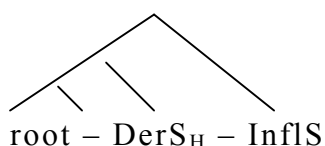
Coming back to the stress algorithms in section 3, we observed that:

- (a) in Greek and Russian derivational suffixes are accentually dominant when competing with other elements; otherwise, the root accent prevails.¹²
- (b) in Thompson Salish, root accent is systematically dominant; otherwise, the lexical suffix accent surfaces.

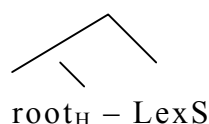
A simpler way of expressing the stress algorithms is by reference to the notion of HEADEDNESS (Revithiadou 1999 and references cited therein): *head accent prevails*.

- (29) *head of a word* (Hoeksema and Janda 1988:220)¹³
 $Head(f(\alpha)) = \alpha$ if $Cat(\alpha) = Cat(f(\alpha))$
 $= f$ otherwise

- (30) a. Greek and Russian



- b. Thompson Salish



- ⊗ Prediction of headedness: Elements that are not heads will not exhibit accentual dominance effects, even if they have an LA.
- ☑ Empirically verified, e.g. Russian diminutive suffixes $/-i\check{s}\check{c}(-a)/$ and $/-ic(-a)/$ (see also Stump 2001:100) where stress is on the accented root (31b):

¹² The Greek and Russian stress facts undermine the validity of McCarthy and Prince's (1995) universally fixed ranking $ROOTFAITH \gg SUFFIXFAITH$. As it stands, this metaconstraint on ranking is too strong for the facts encountered here. There is a growing body of evidence that renders the cross-linguistic force of this asymmetry questionable as well. In Tuyuca (Barnes 1996), aspectual, mood, nominalizing and derivational suffixes have the same segmental inventory as roots. Moreover, they spread their $[\pm nasal]$ feature to inflectional suffixes, specifiers, and similar elements, which are unmarked with respect to the feature $[nasal]$. In Jingulu (Northern Central Australia, Pensalfini 2002), imperatives of motion and negation trigger vowel harmony to roots whereas in Italian (Burzio 1997), derivational suffixes resist vowel shortening and re-stressing. From this perspective, therefore, the accentual dominance of derivational suffixes compared to roots should not be considered as a typological absurdity.

¹³ They follow an idea of Vennemann and Harlow (1977).

- (31) base diminutive
- a. /čast’/ (fem) ‘part’ častíca (fem)
- b. /lúž-a/ (fem) ‘puddle’ lúžica (fem)

- ✓ Question: If prosodic headedness reflects morphological headedness, what enables the interaction between the two components of grammar?
- ☑ Answer: The basic principle that regulates the interface between grammatical components is COMPOSITIONALITY (Montague 1973):

- (32) The prosody of a complex form is a function of the prosody of its parts and of the morphological rules by which they are combined:

$$g(F_M(A,B)) = F_P(g(A), g(B))$$

where: g is a function that maps a morphological constituent into a prosodic constituent, F_M the morphological mode of combination, F_P the prosodic mode of combination, A and B morphological constituents

Roughly, compositionality states that phonology can ‘mirror’ morphology (as well as syntax and semantics) because the components of grammar are built on a par. Cf. MORPHOLOGICAL RECOVERABILITY (Kaye 1974; Van Oostendorp 2004) and MIRRORING (Van Oostendorp and Revithiadou 2005).

- ✓ Question: Which aspects of morphology are *visible* to phonology?

☑ Answer:

- a. different morphological colors
- b. morphological domains (i.e. nodes and the segments they dominate)

Our proposal...

- c. hierarchical relations between nodes (i.e. heads vs. non-heads)

NOTE: The issue of whether node labeling (e.g. N, Adj, V) is visible to phonology is under debate. It is important to mention that phonology *does not* have access to this kind of information (e.g. NP, VP) in the syntax-phonology interface (Selkirk 1995ab, 2000 *et seq.*; Truckenbrodt 1995, 1999).

☒ COLORED constraints referring to:

- morphological domains, e.g. INTEGRITY-ROOT (cf. ROOTFAITH)
- hierarchical relations between nodes, e.g. headedness (cf. HEADFAITH):

- (33) INTEGRITY-HEAD (IH): The LA of the morphological head is the head of the PrW.

- (34) *accented root – accented inflectional suffix*

$V_1 \tilde{V}_2 -, -\tilde{V}_3$	$V \nearrow LA$	$RECIP^{LA}_V$	IH	$LA \searrow$
* * ↑ ↓ ↑ a. $V_1 V_2 - V_3$	*			* _{infl}
* * ↑ ↑ ↓ b. $V_1 V_2 - V_3$	*		*!	* _{root}
* * ↑ ↓ ↑ c. $V_1 V_2 - V_3$	*	* !		* _{infl}

Three types of accent migration are of interest:

Three types of accent migration are of interest:

1. pre-/post-accentuation
2. accent migration due to window restrictions
3. accent migration due to 'deletion' of vocalic material

☒ They all exhibit locality effects.

1. Pre-/post-accentuation has been difficult to grasp by means of the same mechanism (see for example Alderete 1999; Revithiadou 1999) although these accentual patterns seem to be the mirror-image of each other. Intuitively, a morpheme that introduces a pre-/post-accenting LA wants to push it outside its domain (*migration*) but, at the same time, not too far away (*locality*):

- (35) a. post-accenting root

$$V_1 C V_2 - \underset{*}{V_3} - V_4$$


$$V_1 C V_2 - V_3 - V_4$$
- b. pre-accenting suffix

$$V_1 C \underset{*}{V_2} - V_3 - V_4$$


$$V_1 C V_2 - V_3 - V_4$$

⊠ Basic issues: (1) accent migration, (2) locality

1. Accent migration: $\text{RECIP}^{\text{LA}}_{\text{v}}$ guarantees locality to the vowel an LA is lexically associated with. In case, however, such a lexical association is not provided, the LA is apparently free to migrate to the closest (inner or outer) morphological domain (turbidity in accent realization). Recall the restriction in (26) imposed by CoE: projection lines cannot be added, if they are not lexically present or changed, if they are present. In other words...

(36) Migration of floating accents has a DERIVED ENVIRONMENT flavor.

Alternative phrasing: a floating LA cannot be associated with ‘old’ material and all vowels of the morpheme/color it belongs to are ‘old’ material. Therefore, it has to migrate somewhere else.

(37) INVARIANCE:¹⁴ A lexical accent *LA* is pronounced within morpheme/color *M* iff it is projected by a vowel *V* of morpheme/color *M*.

INVARIANCE (a) requires the pronunciation line of an LA to have the same color with it and its projection line; (b) otherwise, to have a different color.

That is, in the absence of projection lines, the scope of the LA is inevitably broadened and automatically all vowels of the same color are cancelled out as potential docking (pronunciation) sites. In other words, if an LA is not lexically associated with a V (through projection lines), it misses any chance it has to be pronounced within this morpheme. As a consequence, it either has to migrate or to be left unpronounced.

¹⁴ Inspired by Wheeler's (1981, 1988) *Principle of Invariance* which states that once an interpretation has been established for a constituent, that interpretation cannot be changed.

(38) *post-accentuation, e.g. Russian*

$V_1V_2\hat{-}, -V_3$	LA ↘	INVAR	DEFAULT
$*$ ↘ a. $V_1V_2-V_3$			*
$*$ ↓ b. $V_1V_2-V_3$		*!	*
$*$ c. $\hat{V}_1V_2-V_3$	*!		

(39) *pre-accentuation, e.g. Greek*

$V_1V_2-, -\hat{V}_3$	LA ↘	INVAR	DEFAULT
$*$ ↘ a. $V_1V_2-V_3$			*
$*$ ↓ b. $V_1V_2-V_3$		*!	*
$*$ c. $\hat{V}_1V_2-V_3$	*!		

2. Locality in accent migration

By migrating to another morpheme/color, an LA expands its scope by 1, 2, ... n syllables depending on how far from its source it drifts away. What pulls back an LA towards its ‘birth place’ is:

(40) $\text{SCOPE}(\text{LA}) \equiv M$: The scope a lexical accent *LA* of morpheme/color *M* is pronounced equals the morpheme/color *M* and no other.

This constraint is violated every time the ‘old’ territory of an LA is expanded by the addition of ‘new’ material.

$V_{1r}V_{2r}\hat{-}, -V_{3s}V_{4s}$	$\text{SCOPE}(\text{LA}) \equiv M$
$*$ _r ↓ a. $\{V_{1r}V_{2r}\}-V_{3s}V_{4s}$	
$*$ _r ↘ b. $\{\{V_{1r}V_{2r}\}-V_{3s}\}V_{4s}$	* V_{3s}
$*$ _r ↘ c. $\{\{V_{1r}V_{2r}\}-V_{3s}V_{4s}\}$	* V_{3s} * V_{4s}

$V_{1r}V_{2r}\hat{-}, -V_{3s}V_{4s}$	LA ↘	INVAR	$\text{SCOPE}(\text{LA}) \equiv M$
$*$ _r ↓ a. $\{V_{1r}V_{2r}\}-V_{3s}V_{4s}$		*!	
$*$ _r ↘ b. $\{\{V_{1r}V_{2r}\}-V_{3s}\}V_{4s}$			* V_{3s}
$*$ _r ↘ c. $\{\{V_{1r}V_{2r}\}-V_{3s}V_{4s}\}$			* V_{3s} * V_{4s} !

☒ Typology of floating accent realization:

- $LA \triangleright \gg INVAR \gg SCOPE(LA) \equiv M$: local migration¹⁵
- $LA \triangleright \gg SCOPE(LA) \equiv M \gg INVAR$: neutralization
- $INVAR, SCOPE(LA) \equiv M \gg LA \triangleright$: non-pronunciation (‘deletion’)

2. Accent migration due to window restrictions: The accent does not really ‘move’; it is simply pronounced on a neighboring vowel that satisfies the window requirement.

- (43) a. fúrnaris (NOM.SG)
*
↑↓
furnar-is
- b. furnáriðes (NOM.PL) ‘baker’
*
↑ ↓
furnar- ið-es 3σ-window
Q: Why not *furnaríðes?

(44)

$\acute{V}_1V_2-, -V_4, -V_5$	3σWINDOW	RECIP ^{LA} _V	$LA \triangleright$	INVAR	SCOPE(LA) $\equiv$ M
* ↑↓		*			
a. $V_1V_2-V_4-V_5$		*			
* ↑ ↓		*		*!	*V ₄
b. $V_1V_2-V_4-V_5$					
* ↑↓	*!				
c. $V_1V_2-V_4-V_5$					

3. Accent migration due to glide formation:

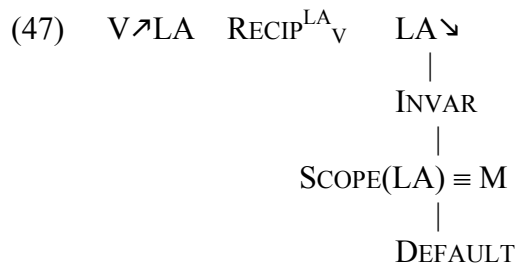
- (45) a. peð-í (NOM.SG)
*
↑↓
peð-i
- b. peð-íu → [peðjú] (GEN.SG) ‘child’
*
↑↓
peð-ju pre-V glide formation

(46)

$V_1V_2-, -\acute{V}_4V_5$	*iV	RECIP ^{LA} _V	$LA \triangleright$	INVAR	SCOPE(LA) $\equiv$ M
* ↑↓	*!				
a. peð-iu					
* ↑↓		*			
b. peð-ju					
* ↓ ↑		*		*!	*
c. peð-ju					

The ranking for *head-based lexical accent systems with accented and post-/pre-accenting morphemes* is:

¹⁵ Contra predictions for long-distance migration (cf. McCarthy (2003), although he discusses floating tones).



5.2. Advantages of CC/TT

⊠ Advantages of the CC/TT model to lexical accentuation

At the empirical level

- It predicts a restricted and attested typology for floating lexical accents and provides the means to express and analyze accent deletion (non-pronunciation) phenomena without invoking additional machinery.
- It provides a uniform representation and analysis for pre-/post-accenting morphemes. Moreover, it does not preclude the existence of both accentual patterns in the same language.
- It adequately accounts for window-driven accent-shifts and migration of accents due to ‘deletion’ of segmental material.

At the theoretical level

- It brings locality and migration (turbidity) of lexical accents under the same roof, namely CoE.
- It dispenses with the problem of employing faithfulness constraints to association lines.
- It provides a principled basis for the formulation of INTERFACE/COLORED CONSTRAINTS:
 1. ICs result from a general property of UG, namely compositionality.
 2. ‘Not anything goes’:
 - ICs are faithfulness constraints (i.e. m-p faithfulness constraints) because they control the m-p mapping. Markedness constraints do not regulate the relation between morphological structure and prosodic form, therefore they can never refer to (aspects of) the interface.
 - visibility is limited by compositionality hence ICs can refer to morphemes, domains, hierarchical relations between nodes, but not to affix classes, lexical strata, lexemes, etc.

6. An alternative analysis to lexical stress

Alderete (1999, 2001ab): root-controlled accent and TRANSDERIVATIONAL ANTI-FAITHFULNESS (TAF) in affix-controlled accent (ACA)

- ACA is morphologically triggered and base-mutating (to mention a few properties).
- Anti-faithfulness: Given the faithfulness constraint F, $\neg F$ is the related Anti-faithfulness constraint which is satisfied in a string S iff S has at least one violation of F.
- OO correspondence (Benua 1997; Kenstowicz 1996; Burzio 1996): morphologically related words may stand in correspondence.

A case study: Russian accentuation (Alderete 1999: 163-170)

- (48) a. /rák-u/ ráku 'crayfish-DAT.SG'
 b. /stol-u/ stolú 'table-DAT.SG'

• Root-accent prevails

Ranking: ROOTFAITH(acc) >> FAITH(acc) >> Default (post-stem stress)

- (49) a. /s'ív-úx-a/ sív'úxa 'raw alcohol'
 b. /skak-úx-a/ skakúxa 'frog'

• Dominant suffix prevails due to TAF and creates opposition in base-derivative pairs (base is *s'ív* and *skak*, respectively).

Ranking: -OODom(acc) >> OO(acc) >> -OORec(acc), ROOTFAITH(acc) >> Default

- (50) a. /lúž-íc-a/ lúžica 'puddle-dim'
 b. /čast'-íc-a/ čast'íca 'particle'

• Recessive suffix loses to root stress because it is not subject to the base mutating effects of TAF. As a result, it does not create opposition in base-derivative pairs (base is *lúž* and *čast'*, respectively).

Ranking: OO(acc) >> -OORec(acc), ROOTFAITH(acc) >> Default

☒ Problems:

1. At the empirical level, (a) TAF misses the generalization that in Russian recessive suffixes are either inflectional or, if derivational, they are not heads (transparency), and (b) if applied to Greek, it suggests that dominance = accentedness. (Note that this comes naturally in CC: heads are reflected on the phonological level only when they bear accents).

2. Affixation is always base-mutating.

a. this is wrong:

- root – Dom Suff_{Acc}

root – Dom Suff_{Acc} – Dom Suff_{Pre-acc} no base-mutation

- root – Dom Suff_{Post-Acc}

root – Dom Suff_{Post-Acc} – Dom Suff_{Acc} no base-mutation

b. it predicts a 'weird' accentual typology for suffixes

- Root: Acc, Post-Acc, Pre-Acc

- Recess Suff: Acc, Post-Acc, Pre-Acc

- Dom Prf: Acc, Post-acc, *Pre-Acc

- Dom Suff: Acc, Pre-Acc, *Post-Acc (but they exist in Greek)

3. Locality of pre-/post-accenting morphemes is derived by constraint conjunction (additional machinery).

4. Why should a morpho-phonological process aim at TAF anyway?

7. Conclusions

➤ Morpho-accentual processes are best treated by means of a theory of enriched representations (TURBIDITY THEORY) and a theory that incorporates CoE and compositionality in its theoretical apparatus (COLORED CONTAINMENT).

➤ CONSISTENCY OF EXPONENCE (McCarthy and Prince 1993ab) imposes a restriction on 'Freedom of Analysis' and bears some interesting consequences for locality effects and accent migration phenomena.

- COLORED CONSTRAINTS are more principled and restrictive than INDEXED CONSTRAINTS because they originate from the principle of compositionality and abide by CoE. Under the present account, it is only natural markedness constraints to not be involved in the m-p interface.
- CC makes more accurate empirical predictions and has greater explanatory force than alternative analyses, e.g. TAF.
- Both CC and TT bring to light the notion of intra- and inter-level ‘visibility’ in phonology, thus providing a useful key to ‘unlocking’ phonological problems that hinge on hidden structure.

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Anthi Revithiadou
Division of Linguistics
Department of Mediterranean Studies
University of the Aegean
1 Demokratias Ave.,
Rhodes GR-85100