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Co-phonologies and morphological exponence in OT

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1 Introduction

As work since Spencer (1998) points out, Optimality Theory redefines the exponence of morphological processes like reduplication, for example, in purely realizational or a-morphous (Anderson 1992) terms:

- The input form of reduplicative morphemes in work since McCarthy & Prince (1993) is simply a label, RED, linking the reduplicative construction to reduplication-specific (B-R) Faithfulness constraints.
- The grammar defined by the interaction of B-R Faithfulness constraints with other constraints is what determines the reduplicative morpheme's output form (or exponence).
    - The input of the reduplicative morpheme is not an 'item' in the Hockettian (1966b) sense.

Co-phonology theory of morphological exponence – developed and motivated within OT in work like Orgun (1996), Inkelas (2008) and Inkelas & Zoll (2005) – explicitly extends the a-morphous potential of OT to all word-formation processes:

- All morphemes are defined as complexes of semantic, syntactic and phonological features linked to the output of hierarchical morphological constructions.
- The phonological 'features' can consist entirely of a constraint grammar, or co-phonology.

The goals of this talk are to:

- Provide a brief introduction to co-phonologies.
- Provide a brief comparison with a leading alternative approach within OT,
    - namely constraint co-indexing (Ito & Mester 2003).
- Introduce new arguments in favor of co-phonologies,
    - based on case studies of reduplication in the Salishan language, Squamish (Skwxwú7mesh), and the Bantu language, Chichewa.

2 Two non-derivational approaches to morphologically-conditioned phonology in OT

2.1 Morphologically-conditioned phonology

By this, we mean phonological patterns which are associated with particular morphological constructions; they are not general in the language.

For example, in English, some affixes affect the stress of their bases, while others do not (Inkelas 2008, etc.):

(1) English affixes and stress:

Noun	*stress-shifting suffix*	*non-stress-shifting suffix*
párent	parént-al	párent-ing
president	presidént-ial	présidenc-y
áctive	actív-ity	áctiv-ist
cóntract	contráct	cóntract-ing

Any phonological grammar of English must link the stress properties of suffixes to output morphological constructions containing these words.

In derivational phonological frameworks, like Lexical Phonology (see recent introductory morphology textbooks, like Spencer, Bauer, Carstairs-McCarthy, Katamba, for overviews), this distinction was analyzed by:

- assigning English affixes to distinct morphological strata,
- assigning blocks of phonological rules to each of the morphological strata,
- word-formation involved the interleaving of morphological affixation – ordered by stratum – with the phonological processes (also potentially ordered) associated with the relevant stratum.

The challenge for a non-derivational theory of phonology, like OT, is to formalize the link between particular morphemes and particular phonological patterns in a non-derivational way.

In the next two sections, I sketch two current models of non-derivational morphologically-conditioned phonology developed within OT:

- co-phonology;
- indexed constraints.

2.2 Co-phonology (Orgun 1996, 1998; Inkelas 1998, 2008; Inkelas & Zoll 2005, 2007; Antilla 2002; among many others)

In co-phonology theory,

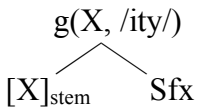
- Each morphological construction is composed of a function bundle.
- The functions defined for the construction relate to its semantics, syntax and phonology.
- A co-phonology is the phonological function associated with a morphological construction – underlying featural (sequence), if any, plus a constraint ranking;
    - this is the exponence of the morpheme.
- Both the underlying form and the constraint ranking are morphological construction-specific.
    - That is, every morphological construction can be associated with its own constraint ranking.

For example, the suffix *–ity* in English would be defined by the following function bundle (Inkelas 2008):

Syntax = N (the output lexical category is Noun)
Semantics = state of being (X)
Phonology = g(X, /ity/),

- [where g*(y)* is a constraint ranking that accomplishes velar softening, stress assignment, trisyllabic laxing, all found in *opaque* → *opacity*.]

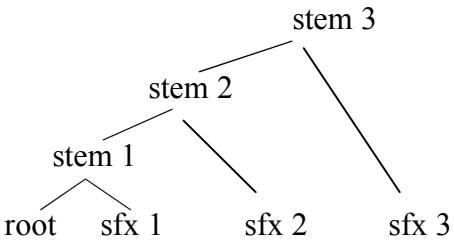
(2) Structural representation of the phonological function (i.e., co-phonology) of stems formed with *-ity*



The hierarchical structure of morphologically complex words

- defines the scope of the co-phonology introduced by each morphological construction which composes it (Inkelas 2008, Inkelas & Zoll 2007):

(3)



That is, the cophonology introduced by suffix 2 can affect the surface form of stem 1 and stem 2;

- it cannot affect the surface form of stem 3.

This theory is <u>non-derivational</u> (see, epecially, Orgun (1996, 1998)):

- co-phonologies are well-formedness constraints on morphological constituent structure, evaluated locally for the part of the structure they have scope over.

This theory is <u>realizational</u> (or amorphous) (see, especially, Orgun (1996, 1998), Inkelas (2008), Inkelas & Zoll (2007)):

- the phonological function of a morpheme is a constraint set, defining the phonological realization of a morpheme;
- the underlying form of morphemes with featural content can also be defined as an argument of the co-phonology, rather than as an input string;
- morphological constructions such as truncation or reduplication would only be distinguished from ones with featural content by having no such featural argument.

2.3 Indexed (or interface) constraints (McCarthy & Prince 1995; Myers & Carleton 1996; Urbanczyk 1996; Itô & Mester 2003; among many others)

Familiar from analysis of reduplication in some of the earliest work in the OT framework:

- morphological-construction-specific Faithfulness constraints – for example, Faith B(ase)-R(eduplicant) – can be interleaved into a fixed ranking of markedness constraints.
- this allows some constructions to have more (or less) marked structure in the output than others.

For example, Itô & Mester (1999, 2003) show that Japanese has four lexical strata relevant to the phonology:

- Native (Yamato) stratum — Core
- Sino-Japanese stratum — ↓
- Assimilated foreign stratum — ↓
- Unassimilated foreign stratum — Periphery

I&M demonstrate that these 4 strata have a core-periphery relationship in the sense that

- in the core stratum, all markedness constraints outrank construction-specific Faithfulness constraints;
- in the peripheral stratum, only syllable structure markedness outranks construction-specific Faithfulness;
- intermediate strata show a nested relationship between Faithfulness and Markedness:
    - the nearer the Core, the more Markedness (M) constraints are respected:

(4) Schematic rankings defining Japanese lexical strata

M1 >> FAITH-UNASSIMILATED >> M2 >> FAITH-ASSIMILATED >> M3 >> FAITH-SINO-JAPANESE >> M4 >> FAITH-YAMATO

The interleaving of construction-specific Faithfulness constraints with a fixed ranking of markedness constraints formalizes this – and all – morphologically-conditioned phonological patterns

This mirrors proposals for the Base-RED relationship (e.g. Urbanczyk 1996) or Root-Affix relationship (Beckman 1997):

- Bases and Roots tend to contain more marked structure (Faithfulness constraints for these morpheme types outrank Markedness constraints);
- REDs and Affixes tend to contain less marked structure (Markedness constraints outrank the Faithfulness constraints for these morpheme types):
    - FAITH-IO >> M1 >> FAITH-BR-ROOT >> M1 >> FAITH-BR

Co-indexing theory is <u>non-derivational</u>:

- a single constraint ranking defines the grammar of the entire language, including all morphologically-conditioned phonology.

This theory is also <u>realizational (a-morphous)</u>:

- ranking of Markedness constraints with construction-specific Faithfulness constraints accounts for a-morphous morpheme realization.
- One can also introduce morphemes into the output using constraints: e.g., ALIGN(L,/-ITY/;R, NOUN) (Yip 1998).

2.4 A comparison

For the most part, both approaches can account for the same range of data.

This is shown in (5), in an example from Anttila (2002: 2), citing Smith (1997):
A language where

- accent placement is usually optimized by a markedness constraint, *M(accent)*,
- except in nouns, where accent remains Faithful to its input position, to satisfy high-ranked $F_{noun}(accent)$.

(5)

(a) Indexed constraint analysis: single constraint ranking
F_{noun}(accent) >> M(accent) >> F(accent)

(b) Co-phonology analysis: distinct constraint ranking for each construction
Nouns: F(accent) >> M(accent)
Other words: M(accent) >> F(accent)

Differences are taken up in detail in Inkelas & Zoll (2007) and Anttila (2002). To summarize main points VERY briefly:

- *Too many solutions problem*: nothing in OT prevents one from co-indexing any constraint with any morphological construction.
    - This means co-indexing can basically imitate co-phonology by repeating all constraints, indexed for different morphological constructions, to whatever extent is necessary to keep a single constraint ranking.
- *Morphological scope*: in co-phonologies, as mentioned above, the scope of a construction-specific phonological realization function is defined by morphological hierarchical structure.
    - In co-indexing, it is defined purely by constraint ranking.
    - Morphological constituency does not play an automatic and well-defined role in linking indexes on constraints to constructions.
- *Markedness reversals*: co-phonology theory allows markedness constraints to have one ranking in some morphological construction(s), and the opposite ranking in others.
    - Co-indexing does not allows this, as the ranking of markedness constraints is fixed for a language.
    - Ranking of faithfulness also fixed, except indexed to particular morphological constructions.
- As Inkelas & Zoll (2007) argue, this power (to allow for markedness reversals) is necessary to account for range of attested morphologically-conditioned phonology. ***– example of this in Squamish and Chichewa, below.***

To sum up, there are good reasons to prefer co-phonologies:

- co-phonology is the more morphologically sophisticated theory, as it assumes hierarchical morphological structure interacts with phonological constraints;
- co-phonology is the more powerful theory:
    - allows both Faithfulness and Markedness constraints to be re-ranked in different morphological constructions in the same language.
    - this power is necessary to account for languages with complex morphologically-conditioned phonology - this is illustrated in the next section.

3 Two reduplication case studies illustrating the advantages of co-phonologies

In this section, I present arguments in favor of co-phonologies, based on case studies of reduplication in Squamish (Skwxwú7mesh) and Chichewa.

What I will show is that Itô & Mester's elegant theory of indexed constraints cannot neatly account for:

- languages like Squamish, which have two (or more) reduplication patterns which are subject to complementary (rather than nested) markedness constraints. – *section 3.1*
- or languages like Chichewa, where tonal transfer (and non-transfer) in the same reduplicative construction applies to Bases subject to two (or more) morphologically-conditioned tone patterns. – *section 3.2*

3.1 Squamish (Skwxwú7mesh) reduplication (Bar-el 2000; Downing 2006: 224-226; 246-248)

As Bar-el (2000) shows, Squamish has two reduplication patterns,

- both show the TETU (emergence of the unmarked) effect found in other Salishan languages:

Pattern 1: RED is CəC, no matter what the Base vowel is – (6a)
Pattern 2: RED is CV, copying exactly the vowel of the Base – (6b)

(6) Squamish reduplication patterns

(a) *CəC reduplication - Pattern 1*

p'əq'^{w} – p'éq'^{w}	'yellow'
təc – téc	'skinny'
k'^{w}əs – k'^{w}ás	'burn'
təq^{w} – tóq^{w}	'red codfish'

(b) *CV reduplication - Pattern 2*

k'^{w}á – k'^{w}ayʔ	'very hungry'
sé – siq	'fly'
pó – pumʔ	'swell'

These two reduplication patterns appear very similar to those found in the related language, Lushootseed.

- However, Bar-el (2000) demonstrates that it is not possible to extend Urbanczyk's (1996, 2006) analysis of Lushootseed to account for the Skwxwú7mesh data.

- In Urbanczyk's (1996, 2006) approach, different markedness restrictions on different reduplicative morphemes like those in Skwxwú7mesh should fall out from the universal FAITH-ROOT >> FAITH-AFFIX ranking.
- But if the CVC reduplicative morpheme is a Root and the CV reduplicative morpheme an Affix, parallel to Lushootseed, then the incorrect outputs are optimal
    - in a uniform constraint ranking that respects MAX-BR-ROOT >> MAX-BR(-AFFIX):

(7) Squamish reduplication - coindexed constraint analysis (Downing 2006)

/RED$_{AFX}$- k'^{w}ay?/	*STRUC	*V-PLACE	MAX-BR-ROOT	NO CODA	MAX - BR
La. k'^{w}a - k'^{w}ay?	*	*!		*	**
Mb. k'^{w}ə - k'^{w}ay?	*			*	***
c. k'^{w}ay?- k'^{w}ay?	*	*!		**	
/RED$_{ROOT}$- k'^{w}ás/					
☞d. k'^{w}əs - k'^{w}ás	*		*(ə)	**	
e. k'^{w}á- k'^{w}as	*	*!	**	*	*
f. k'^{w}ás - k'^{w}as	*	*!		**	

As we can see from the first candidate set,

- The same constraint ranking that correctly optimizes a schwa in the CVC Root reduplicative morpheme,
    - also wrongly optimizes a schwa in the CV Affix reduplicative morpheme.
- Reversing the morphological labeling of the two reduplicative morphemes (and moving *V-PLACE down in the ranking) would give the correct results,
    - BUT would conflict with the strong cross-Salish requirement that Roots have the minimal form CVC, while affixes can violate this constraint.
- Reversing the ranking of MAX-BR-ROOT and MAX-BR-[AFFIX] would also give the correct results,
    - BUT at the expense of violating what is claimed to be the universal ranking of these two constraints.

These problems do not arise in a co-phonology analysis,

- each reduplicative morpheme is labeled as a Root
- and introduces a distinct constraint ranking. (I am following Bar-el (2000) in labeling the CVC reduplicative morpheme Root$_1$ and the CV reduplicative morpheme Root$_2$):

(8) Co-phonology rankings for Skwxwú7mesh reduplication:

(a) Root$_1$ co-phonology: *V-PLACE >> MAX-BR >> NOCODA
(b) Root$_2$ co-phonology: NOCODA >> MAX-BR >> *V-PLACE

Tableaux exemplifying the analysis:

(9) $Root_2$ (CV) reduplication in Skwxwú7mesh

/RED_{ROOT2}- k'^{w}ay?/	MORPH - SYLL	NO CODA	MAX-BR (V-PLACE, SEG)	*V-PLACE
☞a. k'^{w}a - k'^{w}ay?		*	**	*
b. k'^{w}ə - k'^{w}ay?		*	***!	
c. k'^{w}ay?- k'^{w}ay?		**!		*

(10) $Root_1$ (CVC) reduplication in Skwxwú7mesh

/RED_{ROOT1}- k'^{w}ás/	MORPH-SYLL	*V-PLACE	MAX –BR (V-PLACE, SEG)	NO CODA
☞d. k'^{w}əs - k'^{w}ás	*		*	**
e. k'^{w}á- k'^{w}as	*	*!	*	*
f. k'^{w}ás - k'^{w}as	*	*!		**

Abandoning uniform constraint rankings in favor of co-phonologies

- accounts well for cases where we do not find the expected match between morphological category and degree of markedness,
- or where reduplicative morphemes with identical categories show different patterns of markedness reduction,
- as co-phonologies allow for Markedness Reversals.

3.2 Chichewa (Downing 2003)

Chichewa is a major language of Malawi. Two of its dialects – the Ntcheu dialect (Hyman & Mtenje's (1999) "Chichewa-Al") and the Central dialect (Hyman & Mtenje's (1999) "Chichewa-Sam") have been the focus of work on tone and reduplication. (See, too, Kanerva 1990; Myers & Carleton 1996.)

Like most Bantu languages, Chichewa has productive reduplication of verb stems:

(11) Structure of Bantu verbs (Downing 2003)

Subject Prefix - Tense/Aspect - Object Prefix - [$_{stem}$Root - Derivational - IFS]

Like many Bantu languages, High tone contributed by certain Tense/Aspect prefixes in Chichewa is realized in the output on particular positions within the verb stem:

- Final
- Penult

As shown by the data in (12) and (13), when verb stems are reduplicated, tonal transfer is found in both dialects if the verb stem has three or more syllables:

- note labeling of penult vs. final association of tense/aspect (T/A) High tone.

(12) Chichewa-Al and Chichewa-Sam verb stem reduplication, T/A High tone on penult (Hyman & Mtenje 1999: 116, fig (49); '[' marks stem edge)

Base stems of 3+ syllables

Stem	Gloss	do X here and there
ti-sa-[thandíz-e	let's not help	-[thandíze=thandíze
ti-sa-[vundikír-e	let's not cover	-[vundikíre=vundikíre
ti-sa-[fotokozér-e	let's not explain to	-[fotokozére=fotokozére

(13) Chichewa verb reduplication, T/A High tone on final (Hyman & Mtenje 1999: 118, fig (53). '[' marks stem edge)

Base stems of 3+ syllables

Stem	Gloss	do X here and there
(a) Chichewa-Al verb stem reduplication		
ti-[thandiz-é	let's help	-[thandizé= thandizé
ti-[vundikir-é	let's cover	-[vundikiré= vundikiré
ti-[fotokozer-é	let's explain to	-[fotokozeré= fotokozeré

(b) Chichewa-Sam verb stem reduplication

Stem Phrase-medial/Phrase-final (phrase-final)	Gloss	do X here and there
ti-[thandiz-é.../ -[thandíz-e	let's help	-[thandizé=thandíze
ti-[vundikir-é ... / -[vundikír-e	let's cover	-[vundikiré=vundikíre
ti-[fotokozer-é... / -[fotokozér-e	let's explain to	-[fotokozeré=fotokozére

In the Chichewa-Al dialect, as shown in (14), tonal transfer is also found when 1-2 syllable verb stems are reduplicated,

- though the tone pattern is not exactly identical in each half:

(14) Chichewa-Al verbal reduplication, verb stems of 1-2 syllables; '[' marks stem edge

Stem	Gloss	do X here and there
(a) T/A High tone on penult (Hyman & Mtenje 1999: 116, fig (49);)		
ti-sa-[phé	let's not kill	-[phé=i-phé
ti-sa-[mény-e	let's not hit	-[ménye=menyé (*-[ménye=ménye)
ti-sa-[péz-e	let's not find	-[péze=pezé (*-[péze=péze)
(b) T/A High tone on final (Hyman & Mtenje 1999: 118, fig (53))		
ti-[phé	let's kill	-[phé=i-phé
ti-[meny-é	let's hit	-[menyé=menyé
ti-[pez-é	let's find	-[pezé=pezé

In the Chichewa-Sam dialect, we find the single tone domain pattern when these shorter verb stems are reduplicated:

- Notice there is only one High tone within the reduplicative complex in these forms, on the reduplicative suffix,
    - rather than the two we expect from the tonal transfer pattern illustrated by the longer verb stems in the above data:

(15) Chichewa-Sam, verb stems of 1-2 syllables; '[' marks stem edge

	Stem	Gloss	do X here and there
(a)	stem High tone on penult (Hyman & Mtenje 1999: 116, fig (49))		
	ti-sa-[phé	let's not kill	-[phe=í-phe (*-[phé=í-phe)
	ti-sa-[mény-e	let's not hit	-[menye=ménye (*-[ménye=ménye)
	ti-sa-[péz-e	let's not find	-[peze=péze (*-[péze=péze)
(b)	stem High tone on final (Hyman & Mtenje 1999: 118, fig (53))		
	ti-[phé... / -[phé	let's kill	-[phe=í-phe (*-[phé=í-phe)
	ti-[meny-é... / -[mény-e	let's hit	-[menye=ménye (*-[menyé=ménye)
	ti-[pez-é ... / -[péz-e	let's find	-[peze=péze (*-[pezé=péze)

Challenge for co-indexing analysis of morphologically-conditioned tone realization in this data,

- 3 different morpho-syntactic constructions determine output tone position:
    - Grammatical tone position determined by the tense (stem-penult vs. stem-final);
    - Phrasal tone realization constraints;
    - Reduplicative tone realization constraints: tonal transfer or non-transfer, depending on the tense and the length of the stem.

Grammatical tone realization:

- Myers & Carleton (1996) propose that the penult High association pattern satisfies a STEM-NON-FINALITY constraint, in (16b).
- They develop a sort of constraint co-indexing approach to account for final High tone pattern:
    - STEM NONFINALITY is only violated if a High tone occurs on the stem-final syllable in certain paradigms (PRES HABIT, NEG FUT, STRONG SUBJ, …).
    - Violations are ignored in other paradigms (the ones where the stem High tone must surface on the final syllable).

(16) Constraints on Chichewa stem tone realization (adapted Myers & Carleton 1996: 44, fig. (11))

(a) ALIGN BSTEM: ALIGN R(BSTEM, TD)
The right edge of the Base stem is aligned with the right edge of a stem High tone domain.

(b) STEM NONFINALITY:
The right edge of the BStem-final syllable does not coincide with the right edge of a tone domain.

(c) Co-phonology for H final paradigms: Align BStem >> Stem Nonfinality

(d) Co-phonology for penult H paradigms: Stem Nonfinality >> Align BStem

Problem with this co-indexing approach:

- Markedness (alignment), rather than Faithfulness, constraints are co-indexed.
- Difficult to reconceive the analysis in terms of co-indexed Faithfulness constraints, as Faithfulness is violated by both patterns:
    - High tones contributed to the construction by a T/A prefix surface, unfaithfully, on either the penult or the final syllable of the verb stem.

The tableaux below show that the two T/A tone patterns can easily be recast in co-phonology terms.[1]

- The co-phonology rankings are given in (16c) and (16d), above:

(17) Chichewa-Al and Chichewa-Sam dialects - High on stem penult

ndima-[sangalála 'I am happy (habitual)'

/-[sangalala , H/	STEM NONFINALITY	ALIGNBSTEM
☞a. -[sanga(lá)la		*
b. -[sangala(lá)	*!	

(18) Chichewa-Al only –High on stem final

tambalalá 'stretch out your legs!'

/tambalala , H/	ALIGNBSTEM	STEM NONFINALITY
☞a. tambala(lá)		
b. tamba(lá)la	*!	

Phrasal tone realization

As shown by the data above, in the Chichewa-Sam dialect:

- High tone is only realized on the stem-final syllable (in paradigms which take the stem-final High pattern)
- when the verb occurs phrase-medially.
- Phrase-finally, the High tone "retracts" to the penult syllable.

Phrase-final retraction can be accounted for by the NONFINALITY constraint in (19),

- identical to the one in (16b),
- except restricted to apply at all phonological phrase edges instead of having a grammatical context:

(19) PHRASE NONFINALITY:

The right edge of a phonological phrase-final syllable does not coincide with the right edge of a tone domain.

This constraint must be high-ranked in the Chichewa-Sam dialect, where it is active and never violated, but low-ranked in the Chichewa-Al dialect where it is not active (or at least, has a somewhat different output result).

Tone realization in reduplicated verb stems

As noted in introducing the data in (12) – (15),

- we find perfect tonal transfer in both dialects of Chichewa only if the Base stem has three or more syllables and is in a penult High paradigm.
- In other contexts, we find divergence from faithful tonal transfer.
- Indeed, in the Chichewa-Sam dialect, the reduplicative complex is a single tone domain when 1-2 syllable Base stems are reduplicated.

[1] In the Chichewa analysis, I follow Myers & Carleton (1998) in assuming there is a High tone in the input of the verb stems that have a High tone in the output. This assumption is in keeping with the lexicon optimization hypothesis of OT (see, e.g., Itô, Mester & Padgett (1995), Prince & Smolensky (1993)).

The analysis of Chichewa tonal transfer – and non-transfer – developed in Downing (2003) is rather complex. (Time does not permit justifying it in detail.)

- The complete set of constraints and rankings are given below;
- Underlining highlights constraint re-rankings which distinguish the co-phonologies:

(20) Constraints and rankings for Chichewa tonal transfer

Constraints accounting for reduplicative tone (reduplicative constructions are compounds)

(a) ALIGN CSTEM:
ALIGNR(CSTEM, TD): The right edge of the Compound Stem is aligned with the right edge of the stem High tone domain.

(b) ALIGN RSTEM:
ALIGNR(RSTEM, TD) : The right edge of the RED Stem is aligned with the right edge of a High tone domain.

(c) *H: High tone is marked.

(d) *Tonal transfer ranking*:
ALIGNBSTEM, ALIGNRSTEM, ALIGN CSTEM, FAITH-BR >> *H

(e) *Penult H co-phonology, reduplicated stems*:
(PHRASE-NONFINALITY >>) STEM NONFINALITY >> ALIGNBSTEM, FAITH-BR >> ALIGN RSTEM, ALIGN CSTEM >> *H

(f) *Final H co-phonology, reduplicated stems*
(PHRASE-NONFINALITY >>) ALIGN BSTEM, ALIGNRSTEM, ALIGN CSTEM >> FAITH-BR, *H, STEM NONFINALITY

The Chichewa-specific co-phonologies in (20e) and (20f)

- incorporate the morphologically conditioned rankings of STEM NONFINALITY (16b).
- The interaction of NONFINALITY constraints with the tonal transfer constraints in (20d) motivates the rankings given in the two reduplicative co-phonologies.

It is unclear how a coindexed Faithfulness constraint approach could account for this data,

- since the analysis clearly requires Markedness Reversals:
    - Alignment constraints have the opposite rankings *wrt* to each other in different morphological constructions.
    - Recall, what is being aligned is the domain for a High tone which is contributed by a T/A prefix but realized in the verb stem - that is, optimal realization of High tone in both patterns is unFaithful.

4 Conclusion

There are many reasons for morphologically-inclined phonologists to take co-phonologies more seriously than alternative approaches within OT to morphologically-conditioned phonology:

Co-phonologies:

- take hierarchical morphological constituency seriously;
- are non-derivational, so compatible with OT and other declarative models;
- are realizational (a-morphous), so can handle constructions handling both item and process morphologies in the same way.
- Most importantly, they can account for the attested range of morphologically-conditioned phonology,
    - including complex interactions in languages where many morphological constructions trigger a disparate set of phonological processes, like Squamish, Chichewa and English!

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