Constraints on What's Not There:
The Role of Serial Derivations in Subtractive Truncation[1]

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1 Introduction

Familiar types of truncation involve mapping a base form onto a particular prosodic shape. Restrictions apply to surface-present material, and what is deleted may be inconsistent:

(1) Italian Hypocoristics (Thornton, 1996)

	Name	Hypocoristic	(−)
a.	alesándro	ále	*sandro*
b.	enríko	énri	*ko*

In subtractive truncation, however, restrictions apply to the *deleted* constituent, and the prosodic shape of the surface-present material may be inconsistent.

For example, Koasati plural verbs are formed with a truncation process accompanied by an overt suffix (/-li-n/). The truncation pattern is shown in (2):

(2) Koasati Plural Verbs (Weeda, 1991; Martin, 1988; Horwood, 2000)

	Singular	Plural	(−)	Gloss
a.	pitáf	pít	*af*	'slice up the middle'
b.	misíp	mís	*ip*	'wink'
c.	albitíː	albít	*i:*	'place on top of'
d.	apołóː	apół	*o:*	'sleep with someone'
e.	onasanáy	onasán	*ay*	'twist something on'
f.	akocofót	akocóf	*ot*	'jump down'

Unlike truncation processes like (1), subtractive truncation presents a problem for theories of phonology like Optimality Theory (OT) which evaluate surface phonological structure.

> How can constraints on size and location apply to material that isn't there?

[1]Many thanks to John McCarthy and Matt Wolf for insightful discussions of these ideas. This research was supported by grant BCS-0813829 from the National Science Foundation to the University of Massachusetts Amherst.

In this talk, I propose a solution based in Harmonic Serialism (HS), a derivational version of OT. Selection and truncation are accomplished in separate steps, so constraints need not refer to nonexistent material.

Roadmap of the Talk:

§2: Overview of HS and morphological spellout

§3: Multiple exponents: Chaha

§4: Process-based exponents: Tohono O'odham

§5: Koasati plural verbs

2 Theoretical Background

2.1 Harmonic Serialism

Harmonic Serialism (HS) is a derivational variant of Optimality Theory with a number of independent typological advantages over parallel OT (McCarthy, 2000, 2002, 2007, 2008b,a; Pruitt, 2008; Wolf, 2008).

In HS, a derivation proceeds as follows:

a. GEN is restricted to producing candidates that differ from the input by a single instance of a single change.

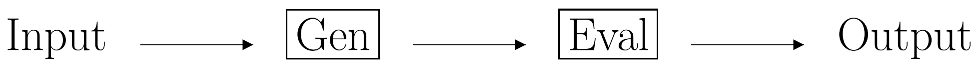
b. This (finite) candidate set is evaluated by the language's constraint hierarchy at EVAL and, like in parallel OT, an optimal candidate is chosen.

c. Instead of exiting as the surface form, the optimal candidate is sent back to GEN — this form serves as the new input.

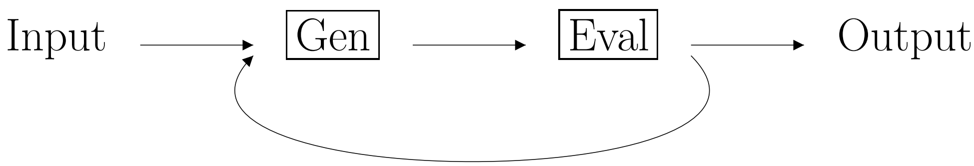
d. A new candidate set is generated, again differing from the (new) input by one single change, and EVAL chooses an optimum from this candidate set.

e. This loop continues until the single changes produced by GEN are no longer harmonically improving. The derivation *converges* when the input is chosen as optimal.

(3) **Parallel Evaluation**



(4) **Serial Evaluation**



2.2 Morphological Spellout

Wolf (2008) proposes an extension to HS, Optimal Interleaving (OI):

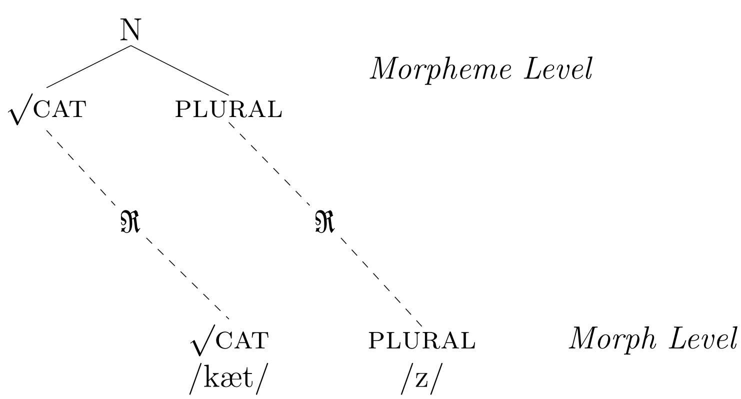
a. Morphological spellout and linearization happens in the phonological component.

b. The input to the HS derivation is an unlinearized morphosyntactic feature tree.

c. Lexical insertion is one of the operations performed by Gen.

A morpheme (a morphosyntactic feature in the input tree) stands in correspondence with a morph (an ordered pair consisting of a feature and a phonological exponent).

(5) **Morphological Correspondence** (Wolf, 2008)



Inserting a morph satisfies a faithfulness constraint demanding that a morphosyntactic feature correspond with an overt morph:

(6) MAX-M(F) (Wolf, 2008): For every instance ϕ of the feature F at the morpheme level, assign a violation-mark if there is not an instance ϕ' of F at the morph level, such that ϕ corresponds to ϕ'.

When morphs are inserted, their linear order is governed by a constraint relating linear order to hierarchical structure. Every affix is designated as a prefix or a suffix, and that determines which periphery it should be linearized to.

(7) MIRROR (for a full definition, see Wolf 2008): Assign a violation mark for every segment intervening between an affix and its designated periphery.

Wolf suggests that a morph can contain a one-to-many relationship between features and exponents, and that exponents may be processes or operations.

In the following sections, I'll present proposals for formalizing these suggestions. Section 3 will address multiple exponents, and Section 4 will address the morphological representation of processes.

Section 5 will demonstrate how these proposals permit an account of subtractive truncation in Koasati.

3 Multiple Exponents

I propose that, within a morph, features stand in correspondence with their exponents:

(8) **Anatomy of a Morph**

Feature *Exponent*

$<$ PLURAL ----- $\mathfrak{R}$ ------- /z/ $>$

When a feature is associated with multiple phonological exponents, it stands in correspondence with each exponent separately:

(9) **Multiple Exponents**

$\langle$ FEATURE ----- $\mathfrak{R}$ ----- /exp_1/ ; ----- $\mathfrak{R}$ ----- /exp_2/ $\rangle$

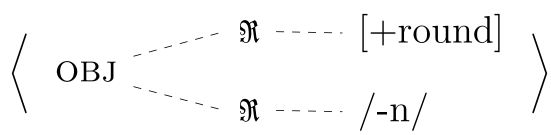
For example, an object marker in Chaha consists of both a floating [+round] (consonantal) feature and the suffix /-n/:

(10) Chaha Object Marking (Rose, 1997; Wolf, 2005)

Without Obj.	**With Obj.**	**Gloss**
a. tɨ-kätif	tɨ-kätif^w-n	'you chop (it)'
b. tɨ-därg	tɨ-därg^w-n	'you hit (it)'

The feature represented by this object marker corresponds to two phonological exponents:

(11) **The Morph**



Insertion of the feature component of a morph without insertion of its corresponding phonological exponents incurs violations of a constraint governing the morph-internal correspondence relationships:

(12) Max-E(F): For a feature f and its corresponding exponent e, assign a violation mark if f is present but e is not.

Inserting morphs incurs segmental markedness constraints. For example, constraints against the marked features [nasal] (/-n/) and [+round]. The ranking of these constraints will determine the order in which the two exponents are inserted.

(13) **Step 1: Root Insertion (not shown)**
Step 2: Morph/Exponent Insertion

tɨ-katif + (obj)	Max-E(obj)	Mirror	*Nasal	*Round
a. tɨ-katif + (obj)	W_2			L
b. tɨ-katif-n	1		W_1	L
c. ☞ tɨ-katif^w	1			1
d. tɨ-kat^{w}if	1	W_2		1
e. tɨ-k^{w}atif	1	W_4		1

Step 3: Exponent Insertion

tɨ-katif^w	MAX-E(OBJ)	MIRROR	*NASAL	*ROUND
a. tɨ-katif^w	W$_1$		L	1
b. ☞ tɨ-katif^w-n			1	1

Step 4: Convergence

tɨ-katif^w-n	MAX-E(OBJ)	MIRROR	*NASAL	*ROUND
a. ☞ tɨ-katif^w-n			1	1

In languages like Chaha, where a single feature corresponds to multiple exponents, the two exponents are spelled out locally.

Because of MIRROR, the preferred spellout locations of the two exponents will always be local — they correspond to the same feature, and that feature's location in the morphosyntactic tree determines the location of its morph.[2]

4 Operations as Exponents

In non-concatenative morphological processes like subtractive truncation, the exponents are not phonological strings or features but templates and operations.

The morphological representation of the template contains a specification (a prosodic unit) for defining a variable. Spelling out a template involves selecting material from the string to be assigned to that variable:

(14) T = μ

Selecting more or less material than the template's specification violates templatic faithfulness constraints:

(15) DEP-T: Assign one violation mark for every unit within the selection that does not belong to the specification.

[2]Locality can, however, be overridden by markedness concerns. Chaha prohibits round coronals; in coronal-final words, the floating [+ROUND] feature docks on the rightmost non-coronal. If there are no non-coronals to dock onto, only the /-n/ suffix is realized.

(16) MAX-T: Assign one violation mark for every unit within the specification that is not within the selection.

An operation defines a change to be performed by GEN. This may include an argument — the unit upon which this operation should be performed — without which the operation cannot be realized.

For subtractive truncation, we need a delinearization operation that takes a template as its argument:

(17) *delinearize(T)*

When a template is delinarized, the linear precedence relationship between its segments and the rest of the string are erased. The delinearized material still exists, but without those precedence relationships it cannot be pronounced.

Why delinearization, and not deletion? In order for constraints like MAX-E(F) to evaluate candidates, we need persistent evidence that the exponent has been spelled out.[3] Deletion erases that evidence.

→ **Question**: How do we restrict the space of possible morphological operations?

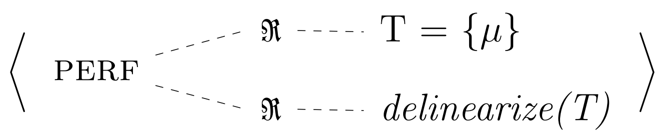
In Tohono O'odham, the formation of the perfective involves truncation of a coda consonant:

(18) Tohono O'odham perfective formation (Hale, 1965; Weeda, 1991; Fitzgerald, 1997)

Impf.	**Perf.**	**(–)**	**Gloss**
a. huhag	huha	*g*	'hauled'
b. gatwid	gatwi	*d*	'shot'
c. maːk	maː	*k*	'gave'

The morph for the IMPF feature contains a template with a single-mora specification and a delinearization operation taking that template as its argument:

(19) **The Morph**



[3]These constraints assign violation marks for operations in a way that is somewhat similar to Anti-Faithfulness.

Without the proper argument, delinearizing segments does nothing to satisfy MAX-E(OBJ). The template will be spelled out first, and its contents subsequently delinearized:

(20) **Step 1: Spell out the root.**

Step 2: Spell out the template.

huhag+(perf)	MAX-E(PL)	MIRROR	DEP-T	MAX-T
a. huhag+ (perf)	W_2			
b. huha | g	W_2			
c. ☞ huha{g}	1			
d. huhag{ }	1			W_1
e. huh{ag}	1		W_1	
f. {h}uhag	1	W_4		

Step 3: Delinearize the template.

huha{g}	MAX-E(PL)	MIRROR	DEP-T	MAX-T
a. huha{g}	W_1			
b. ☞ huha | {g}				

Step 4: Convergence.

huha | {g}	MAX-E(PL)	MIRROR	DEP-T	MAX-T
a. ☞ huha | {g}				

By spelling out the template and the operation one at a time, we're able to select the size and location of the truncated material directly.

5 Putting It All Together: Koasati

Summary: Morphs can contain multiple exponents with correspondence relations obtaining between the feature and each exponent, and those exponents can consist of templates and operations.

Formation of the verbal plural involves: (i) Deletion of a bimoraic syllable rhyme from the right edge and (ii) Addition of an overt suffix.

(21) Koasati Plural Verbs (Weeda, 1991; Martin, 1988; Horwood, 2000)

	Singular	Plural	Gloss
a.	pitáf	pít__-li-n	'slice up the middle'
b.	misíp	mís__-li-n	'wink'
c.	albitíː	albít__-li-n	'place on top of'
d.	apołóː	apół__-ka-n	'sleep with someone'
e.	onasanáy	onasan__-níːci-n	'twist something on'
f.	akocofót	akocóf__-fi-n	'jump down'

(22) **The Morph**

⟨ PLURAL - - - 𝔑 - - - $T = \mu\mu$
- - - 𝔑 - - - *delinearize(T)*
- - - 𝔑 - - - /-li-n/ ⟩

The derivation proceeds as follows:

(23) **Step 1: Spell out the root** (not shown).

Step 2: Spell out the template.

pitaf+(pl)	MAX-E(PL)	MIRROR	DEP-T	MAX-T	*NASAL
a. pitaf + (pl)	W_3				
b. pit | af	W_3				
c. pitaf-li-n	2				W_1
d. ☞ pit{af}	2				
e. pitaf{ }	2			W_2	
f. pita{f}	2			W_1	
g. pi{taf}	2		W_1		
h. p{it}af	2	W_2			

Step 3: Delinearize the template.

pit{af}	MAX-E(PL)	MIRROR	DEP-T	MAX-T	*NASAL
a. pit{af}	W_2				
b. ☞ pit | {af}	1				
c. pit{af}-li-n	1				W_1

Step 4: Spell out the affix.

pit | {af}	MAX-E(PL)	MIRROR	DEP-T	MAX-T	*NASAL
a. pit | {af}	W1				1
b. ☞ pit-li-n | {af}					1

Step 5: Convergence.

pit-li-n | {af}	MAX-E(PL)	MIRROR	DEP-T	MAX-T	*NASAL
a. ☞ pit-li-n | {af}					1

Stepwise spellout of exponents allows direct selection of truncated material, and MIRROR accounts for the locality of the truncation site and the overt suffix.

6 Conclusion

I've presented a serial account of subtractive truncation.

a. A single feature is engaged in correspondence relationships with multiple exponents within a single morph. These exponents must be spelled out one at a time.

b. These exponents include a template and a delinearization operation, building morphological processes.

c. Gradual spellout allows a template to be selected prior to the operations that apply to it, allowing constraints to directly evaluate the size and location of truncated templates.

A quick word about the alternatives:

a. Morpheme constraints like FREE-V (Prince and Smolensky, 1993/2004) build language-specific morphology into the universal constraint set.

b. Anti-Faithfulness accounts (Horwood, 2000) make unwanted typological predictions (e.g. medial and non-local truncation).

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