

# Opaque domain modelling in OT: against stepwise prosodic parsing in Harmonic Serialism

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# Introduction

## Prosodic structure

How should prosody be represented in phonology (OT)

How does the prosodic structure interact with morphosyntax

How does the prosodic structure interact with phonological processes

## Prosody and OT

Accompanies phonological processes

Governed by markedness and structural constraints

No separate mechanism or algorithm

Input status unclear

## Harmonic Serialism

Stepwise approach requires a theory of prosody if assumed that prosodic structure is not built for free

Prosody-morphology interactions and influence of prosody on phonological processes as a driver for architectural changes

## Prosody in HS

### **Elfner (2009):**

parsing operations include core syllable projection (CV) and adjunction (onset/coda) in interaction with parsing constraints; complex margins not projected at one go;

violation count: CV syllable, epenthesis in Arabic inserts a vowel and two moras at one go (epenthetic vowel, resultant coda consonant to satisfy WbP)

## Prosody in HS

### **Pater (2010):**

segment-by-segment syllabification; incorporation in the constraint set in the form of constraints on syllable formation and sonority instead of an external mechanism

### **Pruitt (2008):**

foot assignment mechanism creates a whole foot, mono- or bisyllabic, already contains a head;  
violations of several constraints at once;  
prosodic structure assignment is monotonic (1 foot at a time);  
strict inheritance: changes are inherited from preceding steps 'for subsequent iterations' and are not 'undone'

## Prosody in HS

### **Torres-Tamarit (2012):**

- prosodic constituents create opaque domains in phonology;
- prosodic structure should be built in steps

- core syllabification should be applied in each morph separately
- alignment and parse constraints govern prosodification

- two alignment constraints:

- ALIGN-L(stem, Prosodic Word) and ALIGN-L(Morphological Word, Prosodic Word) prevent the projection of a core syllable (filling onsets, CV) across a prosodic domain

- morphology precedes phonology by arranging roots and affixes hierarchically

## Can the HS model solve overapplication?

Works for Spanish opaque aspiration across a prefix and a word boundary

What about conspiracies / competing repairs?

## Stratal OT

cyclic domain construction, strata

prosody-morphology interactions explained by assigning phonological processes to different domains

its very design assumes serial prosodic structure building associated with morphophonology

each stratum is based on different phonological predictions (different ranking)

## Data: transparent and opaque mappings

1

esto [es.to] 'this'

pesca [pes.ka] 'fishing'

descargar [des.kar.ɣar] 'unload'

desarmar [de.sar.mar] 'disarm'

2

esto [eh.to] 'this'

pesca [peh.ka] 'fishing'

descargar [des.kar.ɣar] 'unload'

desarmar [de.sar.mar] 'disarm'

3

esto [eh.to] 'this'

pesca [peh.ka] 'fishing'

descargar [deh.kar.ɣar] 'unload'

desarmar [de.har.mar] 'disarm'

4

esto [eh.to] 'this'

pesca [peh.ka] 'fishing'

descargar [deh.kar.ɣar] 'unload'

desarmar [de.sar.mar] 'disarm'

# Edges

## Non-opaque mappings

estas [eh.tah] 'these'

estas mesas [eh.tah.me.sah] 'these tables'

estas aguas [eh.ta.sa.ɣwah] 'these waters'

## Opaque mappings

estas [eh.tah]

estas mesas [eh.tah.me.sah]

estas aguas [eh.ta.ha.ɣwah]



# HS solution

## Prevocalic /s/ aspiration in opaque contexts

the relative ranking of alignment and parse constraints is responsible for the different orders of prosodic structure assignment

## Constraints

ALIGN-L(STEM, PWd) » PARSE-SEG » ONSET » \*s]CODA »  
ALIGN-L(MWd, PWd) » PARSE(PWd)

## Torres-Tamarit 2012:120-122

## Step 1

/des+am+ar/	ALIGN-L (STEM,PWD)	PARSE- SEG	ONSET	*S]CODA	ALIGN-L (MWD,PWD)	PARSE (PWD)	IDENT(PI)
a. ↗ des[armar]		8			*	*	
b. (de)(sar)(mar)	*!				*		
c. desarmar	*!	8			*		
d. [desarmar]	*!	8				*	
e. {desarmar}	*!	8			*		

At Step 1, the stem is parsed into a prosodic word given the high ranking of the constraint ALIGN-L(STEM, PWD)

## Torres-Tamarit 2012:120-122

## Step 2

/des[armar]/	ALIGN-L (STEM,PWD)	PARSE- SEG	ONSET	*S]CODA	ALIGN-L (MWD,PWD)	PARSE (PWD)	IDENT(P1)
a. $\varnothing$ (des)[(ar)(mar)]			*	*	*	*	
b. des[armar]		8!			*	*	
c. [des[armar]]		8!				*	
d. {des[armar]}		8!			*		

At Step 2, PARSE-SEG drives syllable projection

## Torres-Tamarit 2012:120-122

## Step 3

/ (des)[(ar)(mar)] /	ONSET	*s]CODA	ALIGN-L (MWD, PWD)	PARSE(PWD)	IDENT(Pl)
a. <del>ɸ</del> (deh)[(ar)(mar)]	*		*	*	*
b. [(des)[(ar)(mar)]]	*	*!		**	
c. (des)[(ar)(mar)]	*	*!	*	*	
d. {(des)[(ar)mar]}	*	*!	*		

At Step 3, high-ranked \*s]CODA mandates coda /s/ debuccalisation

## Torres-Tamarit 2012:120-122

## Step 4

/[deh][ar](mar)/	ONSET	*S]CODA	ALIGN-L(MWD, PWD)	PARSE(PWD)
a. $\varnothing$ [(deh)[ar](mar)]	*			**
b. (deh)[ar](mar)	*		*!	*
c. {(deh)[ar](mar)}	*		*!	*

At Step 4, the whole morphological word, including the prefix, is parsed

## Torres-Tamarit 2012:120-122

## Step 5

/[(deh)[(ar)(mar)]/	ALIGN-L(STEM, PWD)	ONSET	ALIGN-L(MWD, PWD)	PARSE(PWD)
a. $\varnothing$ [(de)[(har)(mar)]	(*)			**
b. [(deh)[(ar)(mar)]		*	*!	**
c. {[(deh)[(ar)(mar)]}		*	*!	

At Step 5, the debuccalised segment is parsed into the following syllable regardless of the prosodic word boundary

this is possible only with a reformulation of the ALIGN-L(STEM, PWD) constraint, which must be active only if there are no input syllables

the same derivation applies to word sequences

## Chilean double repair

- |     |                         |     |                            |
|-----|-------------------------|-----|----------------------------|
| (1) | <b>word level</b>       | (2) | <b>phrase level</b>        |
|     | pesca [peh.ka]          |     | estas [eh.ta]              |
|     | descargar [deh.kar.ɣar] |     | estas mesas [eh.ta.me.sa]  |
|     | desarmar [de.sar.mar]   |     | estas aguas [eh.ta.ha.ɣwa] |

## Rule-based solution

'these'	'these tables'	'these waters'	processes
estas	estas+mesas	estas+aguas	Underlying form
es.tas	es.tas.me.sas	es.tas.a.guas	Syllabification
eh.tah	eh.tah.me.sah	eh.tah.a.guah	Aspiration
eh.tah	eh.tah.me.sah	eh.ta.ha.guah	Resyllabification
eh.ta	eh.ta.me.sa	eh.ta.ha.gua	Deletion

### Order of events

- 2 distinct repair strategies to satisfy the coda condition
- overlap of aspiration and deletion leads to opacity
- aspiration only in word-medial position and in opaque cases across a word-boundary
- /s/ is lost completely at word edges before a pause or a consonant



## Chilean in HS

- MAX(Seg) must be ranked below IDENT(Pl) to enable deletion instead of aspiration before a consonant or a pause
- the sequence *estas aguas* 'these waters' must be parsed into prosodic words separately and only then prosodified further into a phonological phrase to enable resyllabification
- syllabification is blocked in Steps 1-3

# HS derivation of the sequence *estas aguas* 'these waters'

## Step 1

/estas#aguas/	ALIGN-L (STEM, PWD)	PARSE-SEG	ALIGN-L (MWD, PWD)	PARSE(PWD)
a. $\sigma$ [estas]#[aguas]		10		**
b. (es)(tas)#(a)(guas)	**!		**	
c. estas#aguas	**!	10	**	
d. {estas#aguas}	**!	10	**	
e. estas#[aguas]	*!	10	*	*

the sequence is first parsed into prosodic words due to the high-ranked ALIGN-L(STEM, PWD)

# HS derivation of the sequence *estas aguas* 'these waters'

## Step 2

/[estas]#[aguas]/	ALIGN-L (STEM, PWD)	PARSE-SEG	ONSET	*s]CODA	PARSE (PWD)
a. $\mathcal{F}[(es)(tas)]\#[(a)(guas)]$			*	**	**
b. [estas]#[aguas]		10!			**
c. {[estas]#[aguas]}		10!			*

at Step 2, the two words are syllabified separately, in accordance with the ranking (high position of PARSE-SEG)

this is in line with Torres-Tamarit's evaluation of word- and phrase-level overapplication

## HS derivation of the sequence *estas aguas* 'these waters'

### Step 3

/[(es)(tas)]#[(a)(guas)]/	ONSET	*S]CODA	PARSE (PWD)	IDENT(PI)	MAX(Seg)
a. [(eh)(tas)]#[(a)(guas)]	*	**	**	*!	
b. [(es)(tas)]#[(a)(guas)]	*	***!	**		
c. {[(es)(tas)]#[(a)(guas)]}	*	***!			
d. <sup>☞</sup> [(es)(tas)]#[(a)(gua)]	*	**	**		*
e. [(es)(tas)]#[(a)(guah)]	*	*	**	*!	
f. [(es)(tah)]#[(a)(guas)]	*	**	**	*!	
g. <sup>☞</sup> [(es)(ta)]#[(a)(guas)]	*	**	**		*

Step 3 presents a deviation: because deletion is a permitted strategy in Chilean, MAX(Seg) has to be ranked low with this ranking, aspiration will always be suboptimal

## Observations

- aspiration cannot be generated at Step 3  
high-ranked \*s]CODA constraint mandates a repair, but deletion is a better option against the ranking, and resyllabification is banned
- the two words of the sequence are parsed separately and hence are equally good candidates for deletion  
BUT the /s/ of the first word cannot be lost because there is no way of restoring it at a later stage
- the two words are not prosodically combined into a phonological phrase and are therefore evaluated separately, as stand-alone items
- parse the two words together?  
this requires a different ranking of PARSE(PWd)

# Step 4 evaluation of the input [(es)(tas)]#[(a)(guas)] with PARSE(PWD) » \*S]CODA

## Step 4

/[[es)(tas)]#[(a)(guas)]/	ONSET	*S]CODA	ALIGN-L (MWD, PWD)	IDENT (PI)	MAX (Seg)
a. {[(es)(tas)]#[(a)(guas)]}	*!	***			
b. ↗ {[(es)(ta)]#[(sa)(guas)]}		**	*		
c. ⊗ {[(es)(tah)]#[(a)(guas)]}	*!	**		*	
d. {[(eh)(tas)]#[(a)(guas)]}	*!	**		*	
d. {[(es)(ta)]#[(a)(guas)]}	*!	**			*
e. {[(es)(tas)]#[(a)(gua)]}	*!	**			*

## Observations

- HS is unable to account for the Chilean data as long as it cannot independently block resyllabification from applying
- There is no way of aspirating coda /s/ once it is syllabified as an onset because any operation on an onset /s/ would predict that all Chilean /s/ segments are marked and undergo weakening ([s]emana 'week', al[s]a 'growth', co[s]a 'thing'), as well as syllable- and word-final (esto 'this', cosas 'things')
- confusion between the two types of onsets (non-resyllabified and resyllabified) under HS
- addition of prosodification and hierarchical morphological structure that distinguishes between morphs can overcome the problem to some extent
- if a more invasive process is permitted by the ranking, it is enabled because it violates a lower-ranked constraint

## Conclusion

Step-by-step prosodic structure building incorporated in a parallel, operation-by-operation evaluation is insufficient to account for complicated data showing double repairs

The superiority of the Stratal OT framework lies in the fact that its very design assumes serial prosodic structure building associated with morphophonological strata

Each stratum is based on different phonological predictions

Word edges are protected at the word level, while word-internal morpheme edges and morpheme-internal structures are subject to CONTIGUITY

HS does not need to use an extended version of CONTIGUITY, but it does reformulate alignment



## Stratal OT solution

- In Stratal OT terms, Chilean speakers' behaviour confirms that an important distinction must be made at least between word and phrase level phonology
- Although misalignment between the stem and its prosodic structure is permitted (resyllabification), it does not take place inconsequently: opacity at word edges
- Out of the two repairs, aspiration is the only permitted one at word level: (MAX(Seg)»IDENT(PI))
- Deletion is a phrase level process (informed by syntax): a crucial reranking is required, (IDENT(PI)»MAX(Seg))

Word level evaluations of *estas* and *aguas*

/estas/	*S]CODA	MAX(Seg)	IDENT(Pl)
a. es.tas	**!		
b. $\rightarrow$ eh.tah			**
c. eh.ta		*!	*

/aguas/	*S]CODA	MAX(Seg)	IDENT(Pl)
a. a.ywas	*!		
b. $\rightarrow$ a.ywah			*
c. a.ywa		*!	

# Phrase level evaluation of the sequence *estas aguas* 'these waters'

/eh.tah + a.ywah/	ONSET	*s]CODA	ALIGN-L	IDENT(P1)	*h	MAX(Seg)
a. eh.tah.a.ywah	*!				***	
b. eh.ta.ha.ywah			*		***!	
c. eh.tah.a.ywa	*!				**	
d. ☞ eh.ta.ha.ywa			*		**	*
e. eh.tas.a.ywa	*!	*		*	*	*
f. eh.ta.sa.ywa			*	*!	*	*

# Prefixes and PwD CONTIGUITY

## Word-level evaluation

### Preconsonantal

/des+kargar/	ONSET	SSG	*s]CODA	ALIGN-L	MAX(Seg)	IDENT(Pl)	*h
a. $\text{deh.kar.gar}$						*	*
b. $\text{de.kar.gar}$					*!		
c. $\text{des.kar.gar}$			*!				
d. $\text{de.hkar.gar}$		*!		*		*	*

### Prevocalic

/des+armar/	ONSET	CONTIGPW	*s]CODA	ALIGN-L	MAX(Seg)	IDENT(Pl)	*h
a. $\text{des.ar.mar}$	*!		*				
b. $\text{de.sar.mar}$				*			
c. $\text{de.ar.mar}$	*!				*		
d. $\text{deh.ar.mar}$	*!					*	*
e. $\text{de.har.mar}$				*		*!	*

## Phrase level evaluation

/deh.kar.gar/	ONSET	CONTIGPW	*S]CODA	ALIGN-L	IDENT (Pl)	*h	MAX (Seg)
a. $\varnothing$ deh.kar.gar						*	
b. de.kar.gar		*!					*
c. des.kar.gar			*!		*		

# Thank You!

Slides available at: *[www.karolinabros.eu](http://www.karolinabros.eu)*

## Step 3 evaluation of the input [(es)(tas)]#[(a)(guas)] with multiple loci

/[(es)(tas)]#[(a)(guas)]/	ONSET	*S] CODA	PARSE (PWD)	IDENT (Pl)	MAX (Seg)
a. <del>☞</del> [(eh)(tah)]#[(a)(guh)]	*		**	***	
b. [(es)(tas)]#[(a)(guas)]	*	***!	**		
c. {[(es)(tas)]#[(a)(guas)]}	*	***!			
d. [(es)(ta)]#[(a)(gua)]	*	*!	**		**

## Step 3 evaluation of the input [(bes)]#[(ak)(tris)] with multiple loci

/[(bes)]#[(ak)(tris)]/	ONSET	*S]CODA	PARSE(PWD)	IDENT(Pl)	MAX(Seg)
a. [(beh)]#[(ak)(trih)]	*		**	**!	
b. [(bes)]#[(ak)(tris)]	*	**!	**		
c. {[(bes)]#[(ak)(tris)]}	*	**!			
d. <del>☞</del> [(be)]#[(ak)(tri)]	*		**		**

Crucially: discrepancies depending on the input string

Pathological prediction!