Syntax in Phonology? C-Command Over Strings

Thomas Graf

Stony Brook University
mail@thomasgraf.net
http://thomasgraf.net

NECPHON 2017
October 21, 2017

You can get the slides here under "News"

Take-Home Message

A cross-module restriction on well-formedness conditions:

Domain	Phonology	Syntax
bounded	intervocalic voicing	subcategorization
unbounded	sibilant harmony	movement
b + **u**	non-final RHOL	c-command
b + **u** + **b**	*first-last harmony	*sibling of c-commandee

The Main Conjecture: Ban on Improper Locality

Once unbounded, always unbounded.

This talk is mostly about the **phonology** column.

Methodology

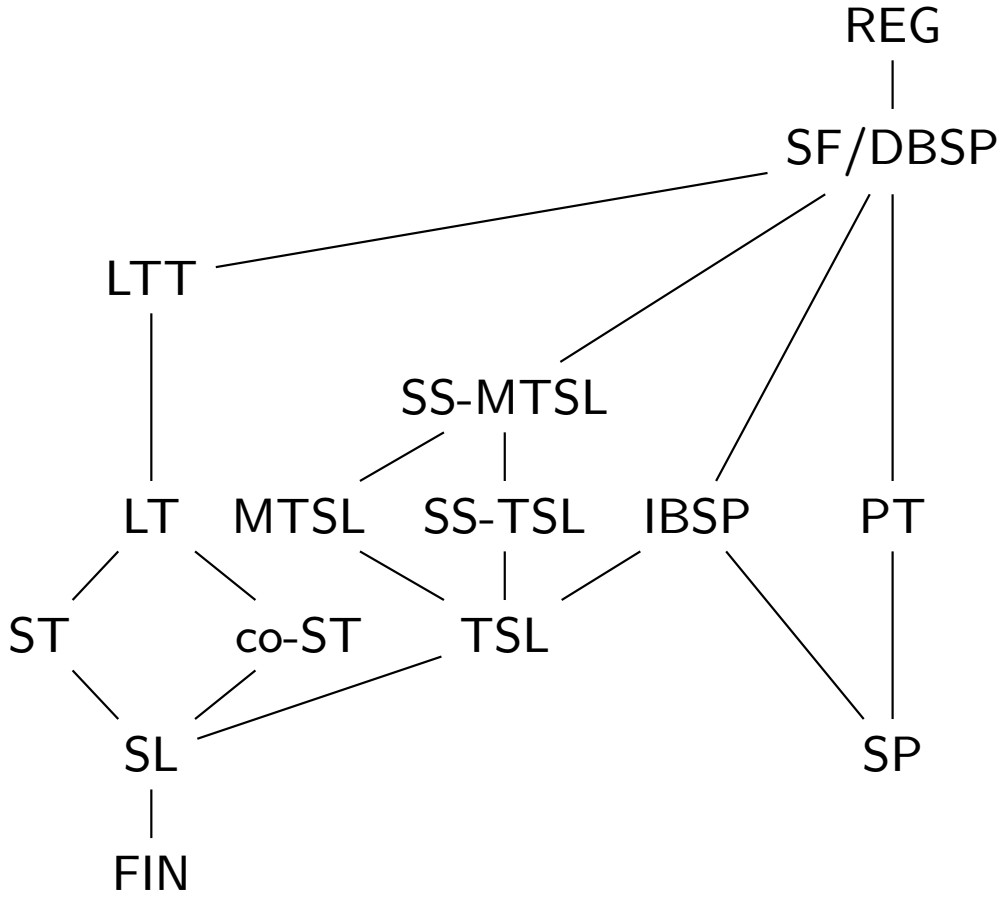
- Only **phonotactics** considered (no input-output mappings)
- **Subregular** phonology as measuring rod for complexity (Heinz 2009, 2010; Heinz et al. 2011; Chandlee 2014; Jardine 2016; McMullin 2016; Graf 2017)

1. define different classes of grammars
2. organize these classes into an expressivity hierarchy
3. needed level of expressivity?

Methodology

- Only **phonotactics** considered (no input-output mappings)
- **Subregular** phonology as measuring rod for complexity (Heinz 2009, 2010; Heinz et al. 2011; Chandlee 2014; Jardine 2016; McMullin 2016; Graf 2017)

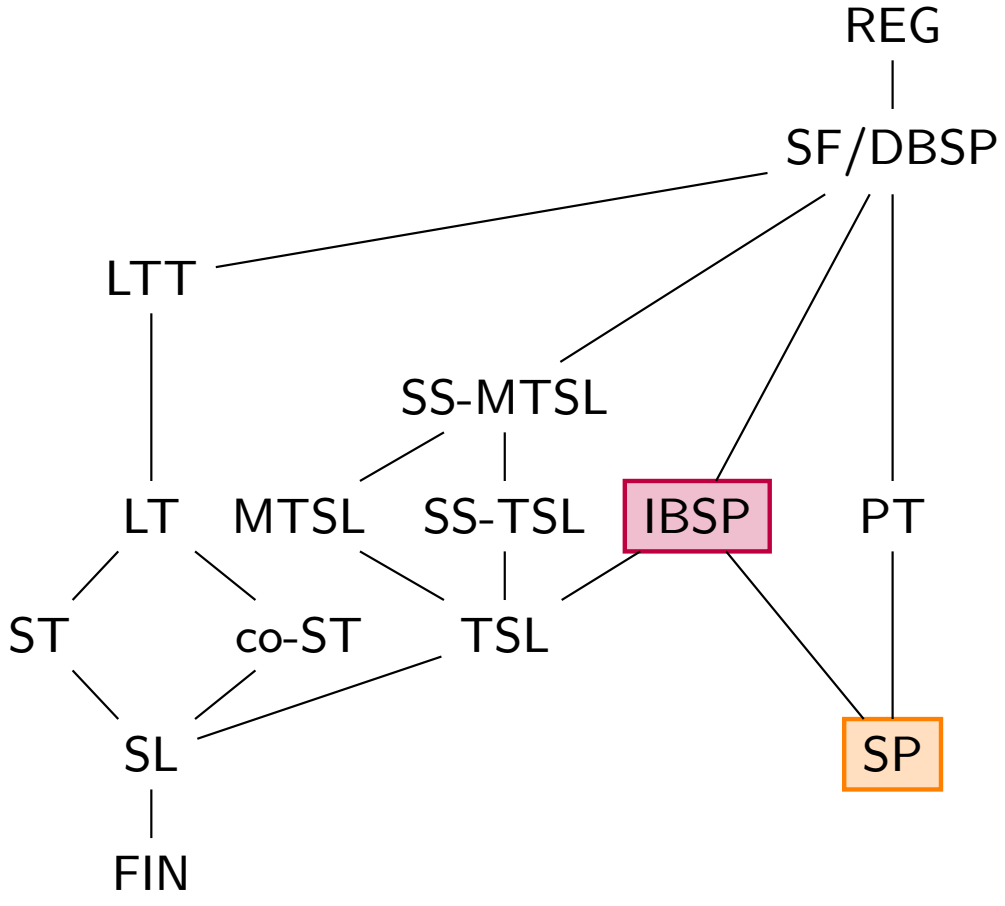
1. define different classes of grammars
2. organize these classes into an expressivity hierarchy
3. needed level of expressivity?



Methodology

- Only **phonotactics** considered (no input-output mappings)
- **Subregular** phonology as measuring rod for complexity (Heinz 2009, 2010; Heinz et al. 2011; Chandlee 2014; Jardine 2016; McMullin 2016; Graf 2017)

1. define different classes of grammars
2. organize these classes into an expressivity hierarchy
3. needed level of expressivity?



Outline

Unbounded Phenomena in Phonology

1. **Samala Sibilant Harmony**
   Sibilants must not disagree in anteriority.
   (Applegate 1972)

   (1) a. * hasxintilawaʃ
   b. * haʃxintilawas
   c. haʃxintilawaʃ

2. **Unbounded Tone Plateauing in Luganda** (UTP)
   No L may occur within an interval spanned by H.
   (Hyman 2011)

   (2) a. LHLLLLL
   b. LLLLLHL
   c. * LHLLLHL
   d. LHHHHHL

Strictly Piecewise Dependencies

- Each phenomenon can be represented by a collection of finitely many **forbidden subsequences**.

Phenomenon	Constraint	Forbidden Subsequences
Sibilant harmony	$^*[\alpha$ ant$]\cdots[-\alpha$ ant$]$	**s∫** , **∫s**
UTP	*HLH	HLH

- A well-formedness condition is **strictly piecewise (SP)** iff it is equivalent to a finite list of forbidden subsequences.

Blocking Effects are Beyond SP

- SP conditions have no notion of locality at all.
- Blocking is a simple form of locality, and hence beyond SP.

Latin L-Dissimilation (Simplified; (Stanton 2016))

- /l/ in morpheme /-alis/ becomes /r/ if stem contains /l/

  (3) a. * lupanalis

  b. lupanaris

- blocked by intervening /r/

  (4) a. fulguralis

  b. * fulguraris

- **Problem for SP**: forbidding l···l for (3a) also rules out (4a)

Locality Domains are Beyond SP

- There is also a problem with the SP account of UTP.
- *H···L···H bans any L between H, no matter what.
- But tone processes are known to also apply across words.
- Unless we limit representations to single words, *H···L···H overapplies.

(5) a. *LHLLLHLL

b. LHL$LHLL

- The word boundary $ should block tone plateauing, but blocking effects are not SP.

SP + Locality = IBSP

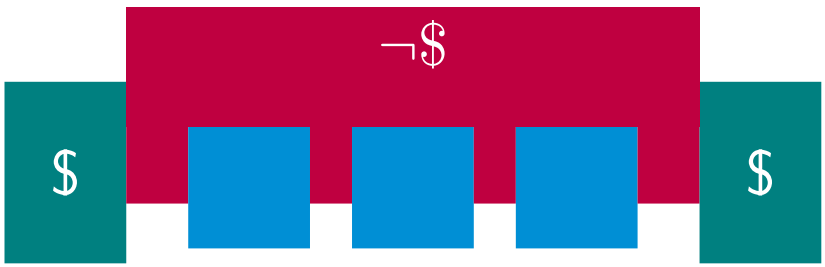
- The central problem of SP is the lack of locality domains.
- **Danger:** arbitrary domains push SP to DBSP $\Rightarrow$ too powerful
- **Restricted version:** SP limited to specific intervals

Interval-Based Strictly Piecewise (IBSP)

1. Finite list of forbidden subsequences
2. Application domain, encoded as **k-val**

3-val for UTP

- Forbidden subsequence: *HLH
- Locality domain:
  - spans between two $,
  - and no other $ occurs between them.
- Represented as a 3-val:

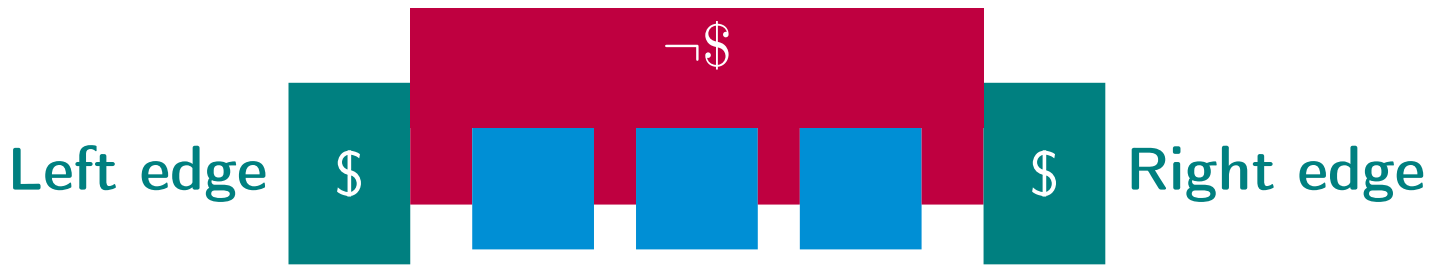


3-val for UTP

- Forbidden subsequence: *HLH
- Locality domain:
  - spans between two $,
  - and no other $ occurs between them.
- Represented as a 3-val:

3-val for UTP

- Forbidden subsequence: *HLH
- Locality domain:
  - spans between two $,
  - and no other $ occurs between them.
- Represented as a 3-val:

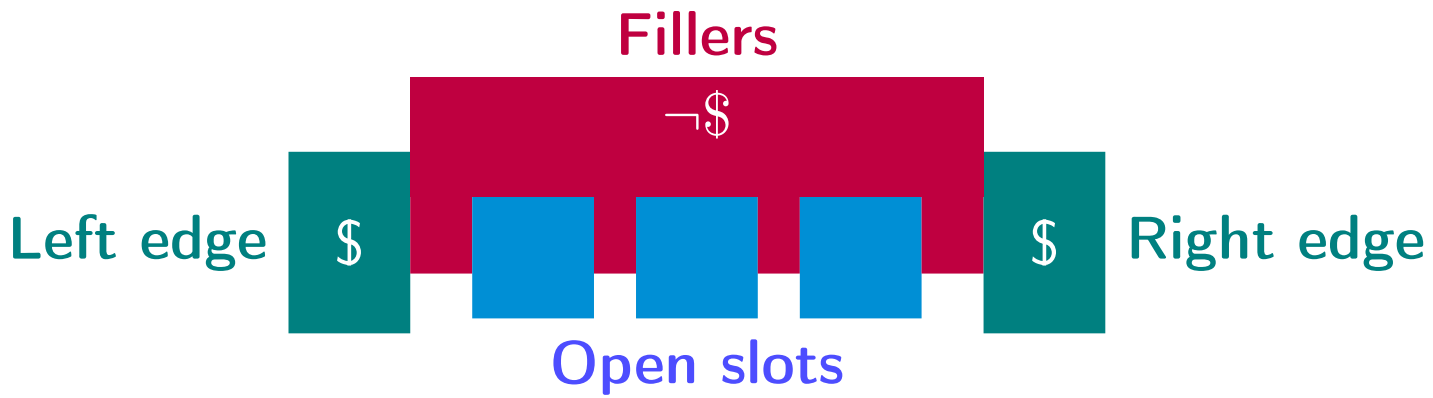


3-val for UTP

- Forbidden subsequence: *HLH
- Locality domain:
  - spans between two $,
  - and no other $ occurs between them.
- Represented as a 3-val:

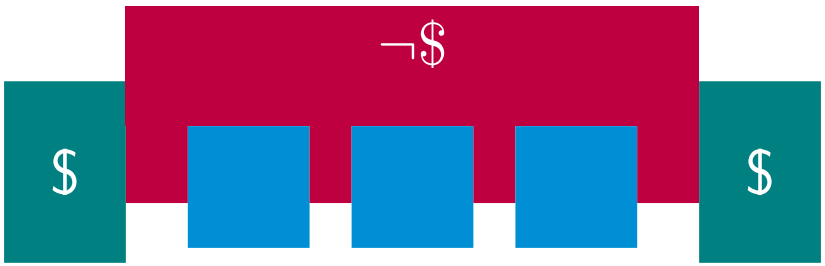
3-val for UTP

- Forbidden subsequence: *HLH
- Locality domain:
  - spans between two $,
  - and no other $ occurs between them.
- Represented as a 3-val:



Restricting *HLH with the k-Val

- *HLH applies only to segments in a matching interval



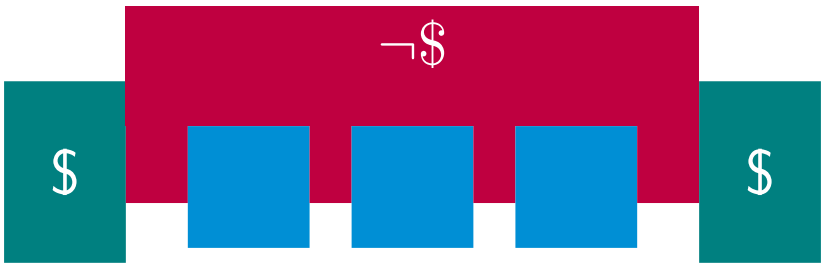
* $ L H L L L H L L $

- If both H are in different words, the 3-val cannot match.

$ L H L L $ H L L $

Restricting *HLH with the k-Val

- *HLH applies only to segments in a matching interval



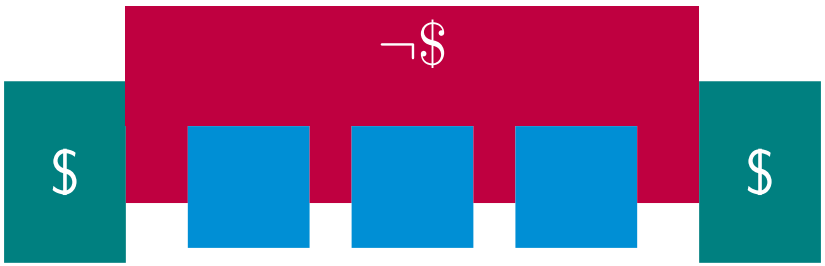
* $ L H L L L H L L $

- If both H are in different words, the 3-val cannot match.

$ L H L L $ H L L $

Restricting *HLH with the k-Val

- *HLH applies only to segments in a matching interval



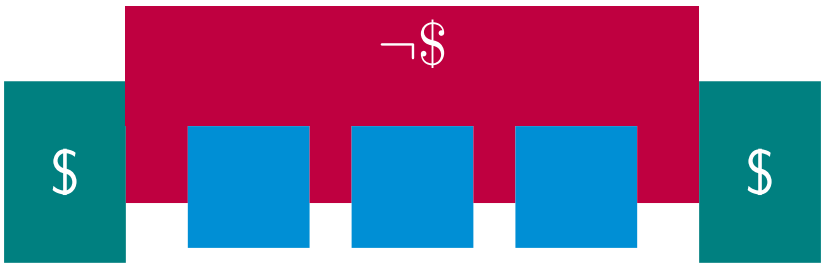
* $ L H L L L H L L $

- If both H are in different words, the 3-val cannot match.

$ L H L L $ H L L $

Restricting *HLH with the k-Val

- *HLH applies only to segments in a matching interval

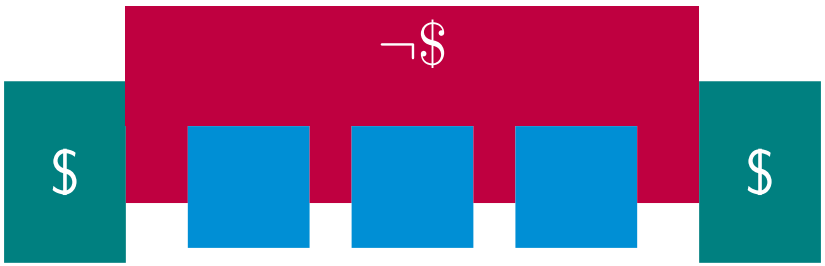


- If both H are in different words, the 3-val cannot match.

$ L H L L $ H L L $

Restricting *HLH with the k-Val

- *HLH applies only to segments in a matching interval

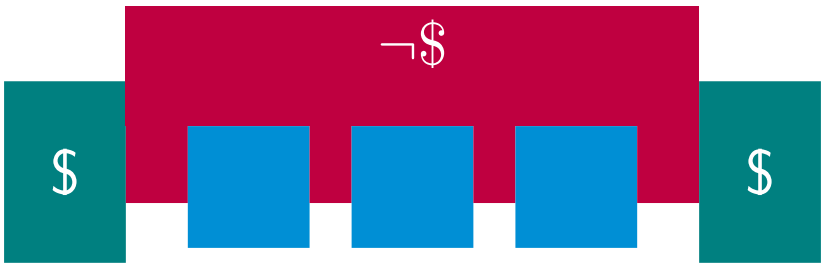


- If both H are in different words, the 3-val cannot match.

$ L H L L $ H L L $

Restricting *HLH with the k-Val

- *HLH applies only to segments in a matching interval

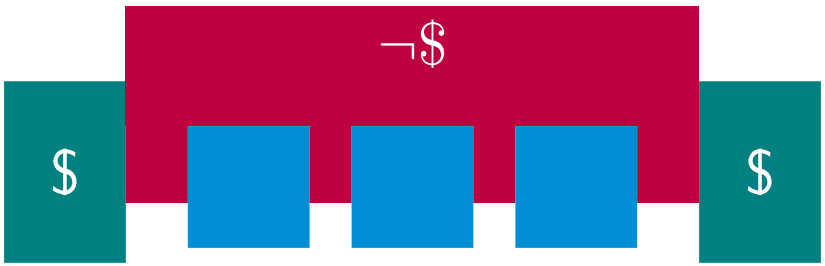


- If both H are in different words, the 3-val cannot match.

$ L H L L $ H L L $

Restricting *HLH with the k-Val

- *HLH applies only to segments in a matching interval

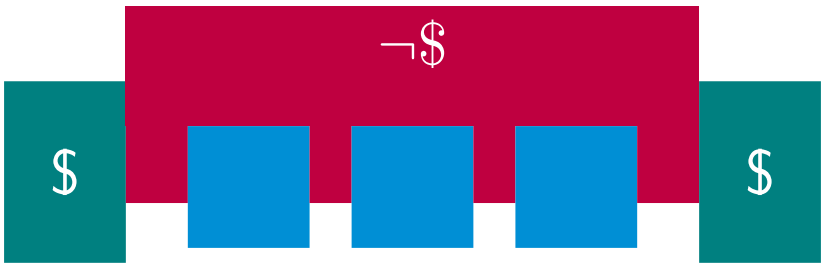


- If both H are in different words, the 3-val cannot match.

$ L H L L $ H L L $

Restricting *HLH with the k-Val

- *HLH applies only to segments in a matching interval

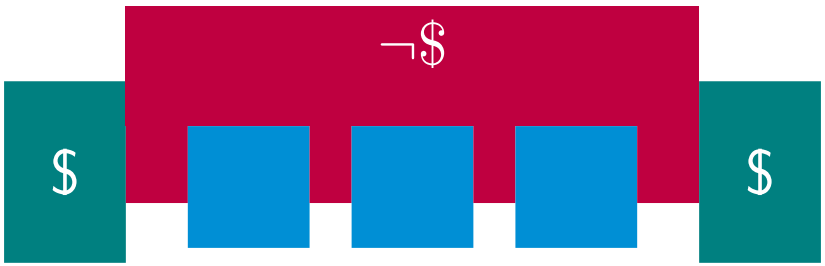


- If both H are in different words, the 3-val cannot match.

$ L H L L $ H L L $

Restricting *HLH with the k-Val

- *HLH applies only to segments in a matching interval

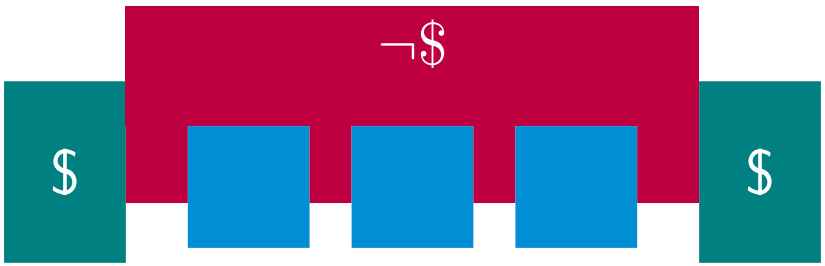


- If both H are in different words, the 3-val cannot match.

$ L H L L $ H L L $

Restricting *HLH with the k-Val

- *HLH applies only to segments in a matching interval

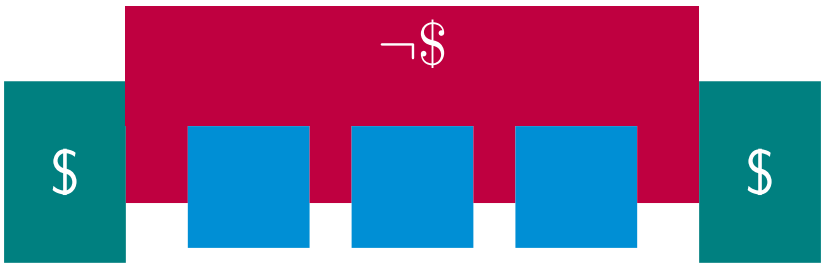


- If both H are in different words, the 3-val cannot match.

$ L H L L $ H L L $

Restricting *HLH with the k-Val

- *HLH applies only to segments in a matching interval

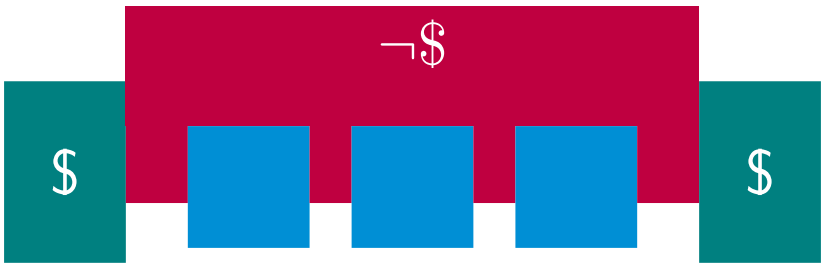


- If both H are in different words, the 3-val cannot match.

$ L H L L $ H L L $

Restricting *HLH with the k-Val

- *HLH applies only to segments in a matching interval

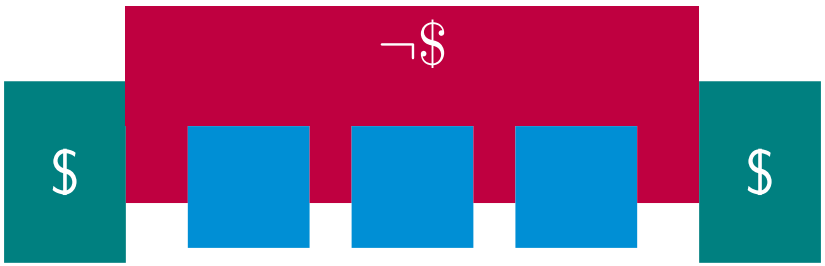


- If both H are in different words, the 3-val cannot match.

$ L H L L $ H L L $

Restricting *HLH with the k-Val

- *HLH applies only to segments in a matching interval

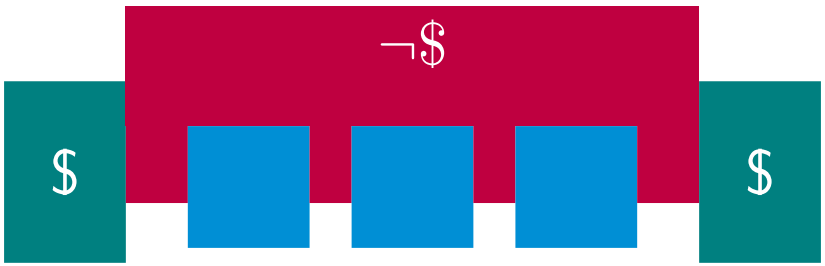


- If both H are in different words, the 3-val cannot match.

$ L H L L $ H L L $

Restricting *HLH with the k-Val

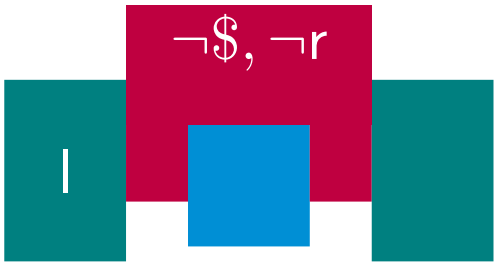
- *HLH applies only to segments in a matching interval



- If both H are in different words, the 3-val cannot match.

R-Blocking for Latin L-Dissimilation

- A simple constraint: *l
- With a peculiar domain:

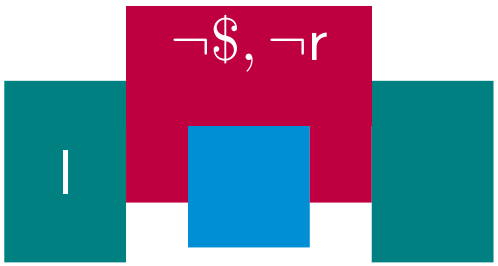


* $ l u p a n a l i s $

$ f u l g u r a l i s $

R-Blocking for Latin L-Dissimilation

- A simple constraint: *l
- With a peculiar domain:

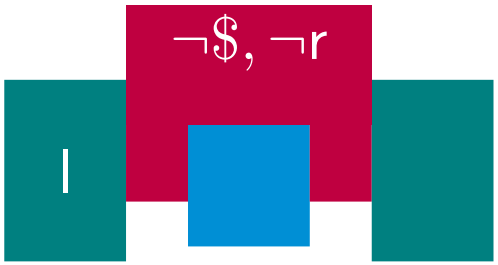


* $ l u p a n a l i s $

$ f u l g u r a l i s $

R-Blocking for Latin L-Dissimilation

- A simple constraint: *l
- With a peculiar domain:

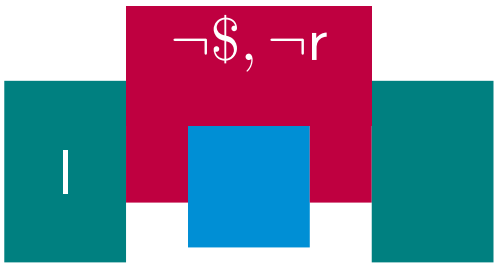


* $ l u p a n a l i s $

$ f u l g u r a l i s $

R-Blocking for Latin L-Dissimilation

- A simple constraint: *l
- With a peculiar domain:

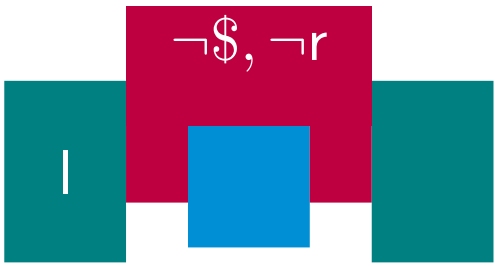


* $ l u p a n a l i s $

$ f u l g u r a l i s $

R-Blocking for Latin L-Dissimilation

- A simple constraint: *l
- With a peculiar domain:

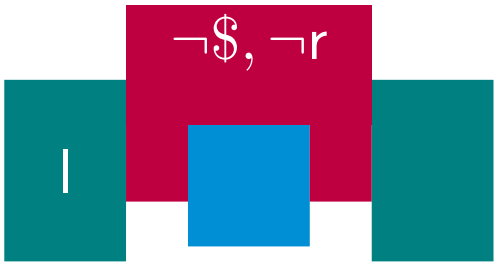


* $ l u p a n a l i s $

$ f u l g u r a l i s $

R-Blocking for Latin L-Dissimilation

- A simple constraint: *l
- With a peculiar domain:

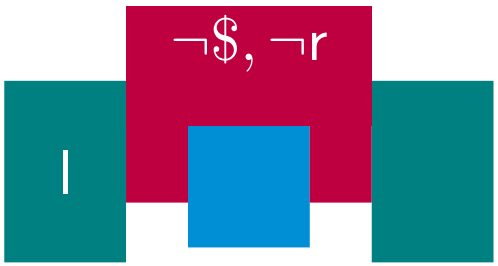


* $ l u p a n a l i s $

$ f u l g u r a l i s $

R-Blocking for Latin L-Dissimilation

- A simple constraint: *l
- With a peculiar domain:



$ f u l g u r a l i s $

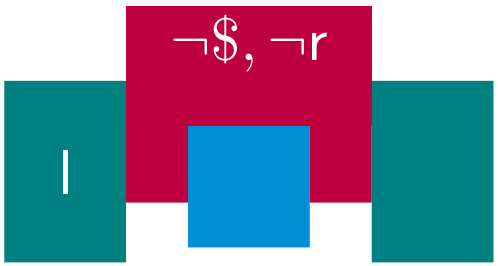
R-Blocking for Latin L-Dissimilation

- A simple constraint: *l
- With a peculiar domain:

$ f u l g u r a l i s $

R-Blocking for Latin L-Dissimilation

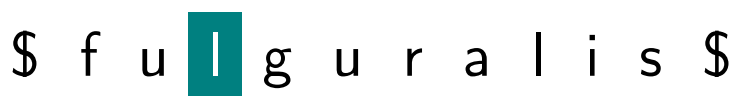
- A simple constraint: *l
- With a peculiar domain:



$ f u l g u r a l i s $

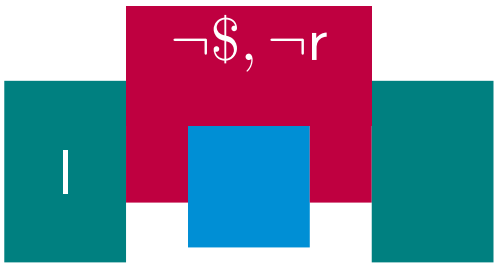
R-Blocking for Latin L-Dissimilation

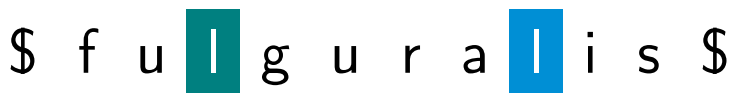
- A simple constraint: *l
- With a peculiar domain:



R-Blocking for Latin L-Dissimilation

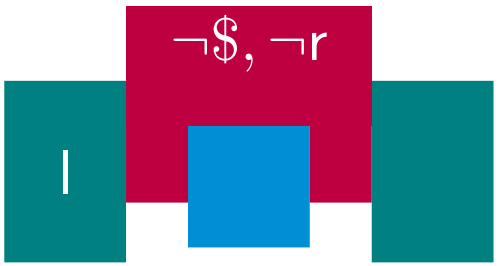
- A simple constraint: *l
- With a peculiar domain:





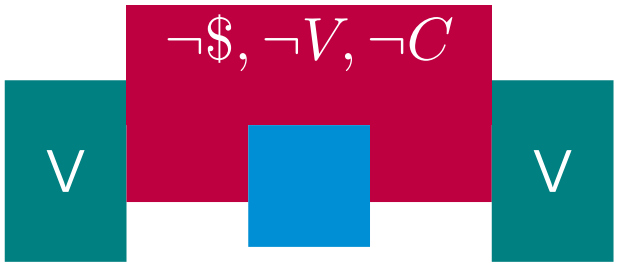
R-Blocking for Latin L-Dissimilation

- A simple constraint: *l
- With a peculiar domain:



Local Constraints are IBSP

- Local constraints are IBSP conditions without fillers.
- **Example:** intervocalic voicing
  - **Forbidden:** [-voiced]
  - **Domain:** between vowels, with no fillers

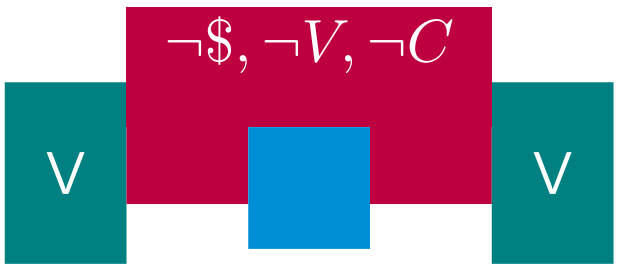


* $ c o g e $ k i p a n $

$ c o g e $ k i b a n $

Local Constraints are IBSP

- Local constraints are IBSP conditions without fillers.
- **Example:** intervocalic voicing
  - **Forbidden:** [-voiced]
  - **Domain:** between vowels, with no fillers

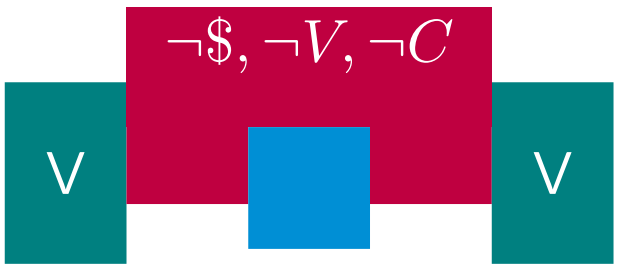


* $ c o g e $ k i p a n $

$ c o g e $ k i b a n $

Local Constraints are IBSP

- Local constraints are IBSP conditions without fillers.
- **Example:** intervocalic voicing
  - **Forbidden:** [-voiced]
  - **Domain:** between vowels, with no fillers

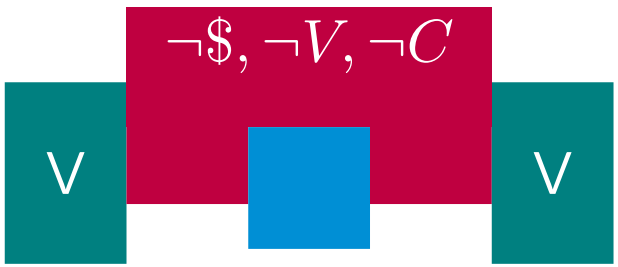


* $ c o g e $ k i p a n $

$ c o g e $ k i b a n $

Local Constraints are IBSP

- Local constraints are IBSP conditions without fillers.
- **Example:** intervocalic voicing
  - **Forbidden:** [-voiced]
  - **Domain:** between vowels, with no fillers

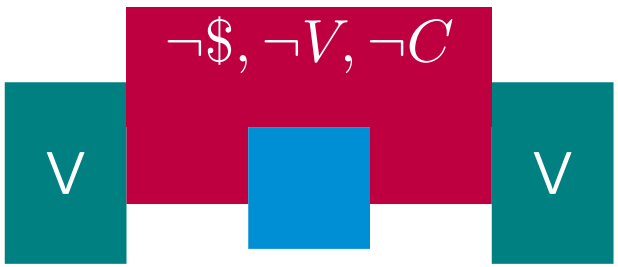


* $ c o g e $ k i p a n $

$ c o g e $ k i b a n $

Local Constraints are IBSP

- Local constraints are IBSP conditions without fillers.
- **Example:** intervocalic voicing
  - **Forbidden:** [-voiced]
  - **Domain:** between vowels, with no fillers

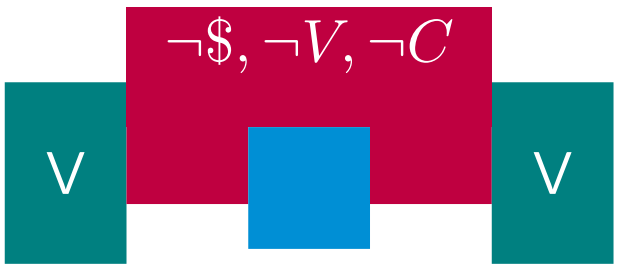


* $ c o g e $ k i p a n $

$ c o g e $ k i b a n $

Local Constraints are IBSP

- Local constraints are IBSP conditions without fillers.
- **Example:** intervocalic voicing
  - **Forbidden:** [-voiced]
  - **Domain:** between vowels, with no fillers

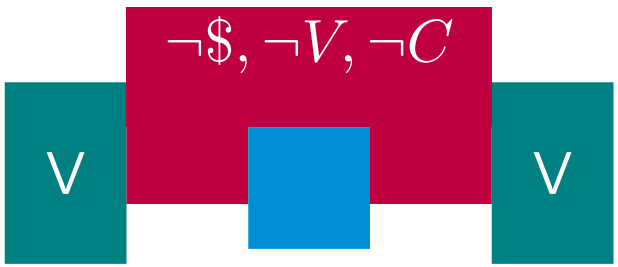


* $ c o g e $ k i p a n $

$ c o g e $ k i b a n $

Local Constraints are IBSP

- Local constraints are IBSP conditions without fillers.
- **Example:** intervocalic voicing
  - **Forbidden:** [-voiced]
  - **Domain:** between vowels, with no fillers

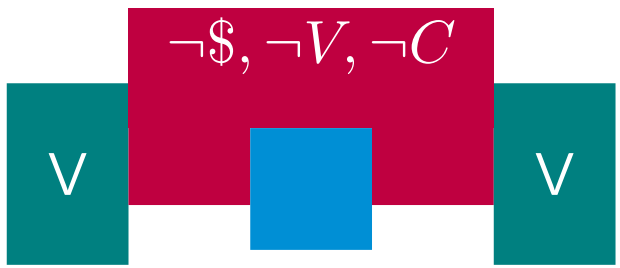


* $ c o g e $ k i p a n $

$ c o g e $ k i b a n $

Local Constraints are IBSP

- Local constraints are IBSP conditions without fillers.
- **Example:** intervocalic voicing
  - **Forbidden:** [-voiced]
  - **Domain:** between vowels, with no fillers

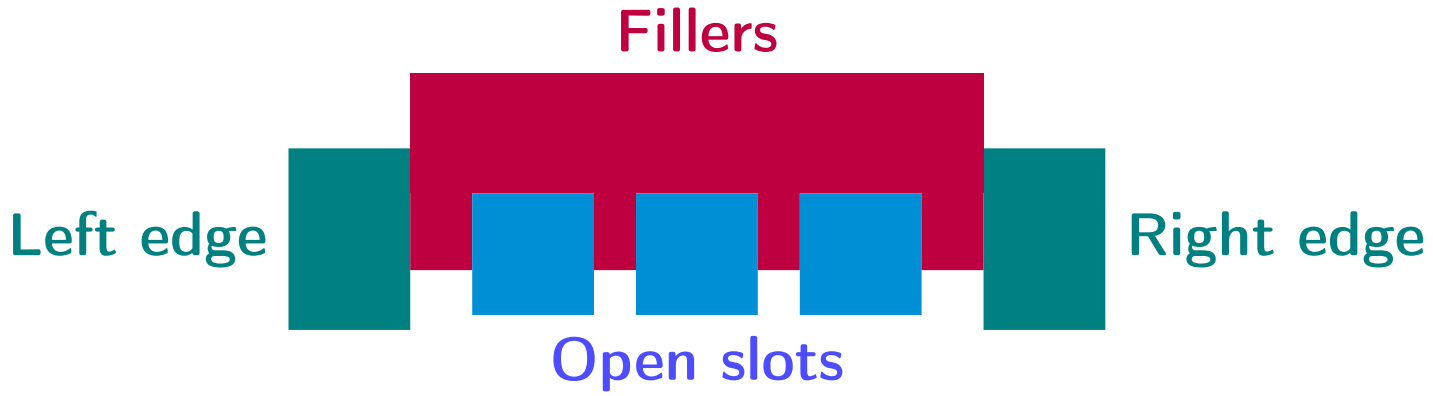


* $ c o g e $ k i p a n $

$ c o g e $ k i b a n $

Prediction: Local and Non-Local Do Not Mix

- All k-vals follow the same base template:



- To enforce adjacency, we have to ban all potential fillers.
- But without fillers, we get **adjacency across the board**!

- **IBSP Prediction:** Local and non-local do not mix.

Non-Local Local Phenomena Exist!

- The IBSP prediction is **false**!
- Some phenomena combine local and non-local information:
  1. non-local blocking of local dissimilation (Samala) (Applegate 1972; McMullin 2016)
  2. non-final RHOL (Eastern Cheremis, Dongolese Nubian) (Hayes 1995; Baek 2017)
  3. non-local trigger of ternary spreading (Copperbelt Bemba) (Bickmore and Kula 2013; Jardine 2016)
- **Conclusion:** IBSP needs a more fine-grained notion of k-val.

Non-Local Blocking of Local Dissimilation

1. **Local Dissimilation in Samala. . .**
   [sn], [sl], [st] are forbidden. . .
2. **. . . With Non-Local Blocking**
   . . .unless there is another [s] later on in the same word

* $ s n a n ʔ $

$ s n e t u s $

Non-Local Blocking of Local Dissimilation

1. **Local Dissimilation in Samala. . .**
   [sn], [sl], [st] are forbidden. . .
2. **. . . With Non-Local Blocking**
   . . .unless there is another [s] later on in the same word

*n
*l
*t

* $ s n a n ʔ $
$ s n e t u s $

Non-Local Blocking of Local Dissimilation

1. **Local Dissimilation in Samala...**
   [sn], [sl], [st] are forbidden...
2. **...With Non-Local Blocking**
   ...unless there is another [s] later on in the same word

* $ s n a n ʔ $

$ s n e t u s $

Non-Local Blocking of Local Dissimilation

1. **Local Dissimilation in Samala...**
   [sn], [sl], [st] are forbidden...
2. **...With Non-Local Blocking**
   ...unless there is another [s] later on in the same word

* $ s n a n ʔ $

$ s n e t u s $

Non-Local Blocking of Local Dissimilation

1. **Local Dissimilation in Samala...**
   [sn], [sl], [st] are forbidden...
2. **...With Non-Local Blocking**
   ...unless there is another [s] later on in the same word

* $ s n a n ʔ $

$ s n e t u s $

Non-Local Blocking of Local Dissimilation

1. **Local Dissimilation in Samala...**
   [sn], [sl], [st] are forbidden...
2. **...With Non-Local Blocking**
   ...unless there is another [s] later on in the same word

* $ s n a n ʔ $

$ s n e t u s $

Non-Local Blocking of Local Dissimilation

1. **Local Dissimilation in Samala. . .**
   [sn], [sl], [st] are forbidden. . .
2. **. . . With Non-Local Blocking**
   . . .unless there is another [s] later on in the same word

Non-Local Blocking of Local Dissimilation

1. **Local Dissimilation in Samala...**
   [sn], [sl], [st] are forbidden...
2. **...With Non-Local Blocking**
   ...unless there is another [s] later on in the same word

* $ s n a n ʔ $

$ s n e t u s $

Non-Local Blocking of Local Dissimilation

1. **Local Dissimilation in Samala. . .**
   [sn], [sl], [st] are forbidden. . .
2. **. . . With Non-Local Blocking**
   . . .unless there is another [s] later on in the same word

Non-Local Blocking of Local Dissimilation

1. **Local Dissimilation in Samala. . .**
   [sn], [sl], [st] are forbidden. . .
2. **. . . With Non-Local Blocking**
   . . .unless there is another [s] later on in the same word

Non-Local Blocking of Local Dissimilation

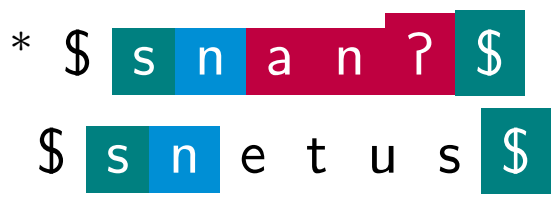
1. **Local Dissimilation in Samala. . .**
   [sn], [sl], [st] are forbidden. . .
2. **. . . With Non-Local Blocking**
   . . .unless there is another [s] later on in the same word

Non-Local Blocking of Local Dissimilation

1. **Local Dissimilation in Samala. . .**
   [sn], [sl], [st] are forbidden. . .
2. **. . . With Non-Local Blocking**
   . . .unless there is another [s] later on in the same word

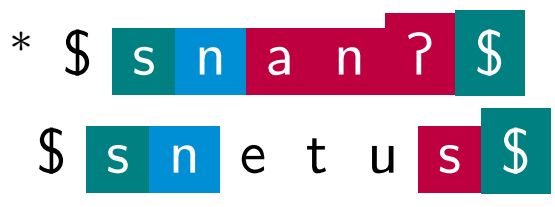
Non-Local Blocking of Local Dissimilation

1. **Local Dissimilation in Samala. . .**
   [sn], [sl], [st] are forbidden. . .
2. **. . . With Non-Local Blocking**
   . . .unless there is another [s] later on in the same word



Non-Local Blocking of Local Dissimilation

1. **Local Dissimilation in Samala. . .**
   [sn], [sl], [st] are forbidden. . .
2. **. . . With Non-Local Blocking**
   . . .unless there is another [s] later on in the same word



Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*	$	Ĺ	L	H	H	H	$
*	$	L	Ĺ	H	H	H	$
*	$	L	L	Ḧ	H	H	$
*	$	L	L	H	H	Ḧ	$
	$	L	L	H	Ḧ	H	$

Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

*	$	Ĺ	L	H	H	H	$
*	$	L	Ĺ	H	H	H	$
*	$	L	L	Ḧ	H	H	$
*	$	L	L	H	H	Ḧ	$
	$	L	L	H	Ḧ	H	$

Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

* $ Ĺ L H H H $
* $ L Ĺ H H H $
* $ L L Ĥ H H $
* $ L L H H Ĥ $
$ L L H Ĥ H $

Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

*	$	Ĺ	L	H	H	H	$
*	$	L	Ĺ	H	H	H	$
*	$	L	L	Ĥ	H	H	$
*	$	L	L	H	H	Ĥ	$
	$	L	L	H	Ĥ	H	$

Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

*	$	Ĺ	L	H	H	H	$
*	$	L	Ĺ	H	H	H	$
*	$	L	L	Ĥ	H	H	$
*	$	L	L	H	H	Ĥ	$
	$	L	L	H	Ĥ	H	$

Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

*	$	Ĺ	L	H	H	H	$
*	$	L	Ĺ	H	H	H	$
*	$	L	L	Ĥ	H	H	$
*	$	L	L	H	H	Ĥ	$
	$	L	L	H	Ĥ	H	$

Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

*	$	Ĺ	L	H	H	H	$
*	$	L	Ĺ	H	H	H	$
*	$	L	L	Ĥ	H	H	$
*	$	L	L	H	H	Ĥ	$
	$	L	L	H	Ĥ	H	$

Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

* $ Ĺ L H H H $
* $ L Ĺ H H H $
* $ L L Ĥ H H $
* $ L L H H Ĥ $
$ L L H Ĥ H $

Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

* $ Ĺ L H H H $

* $ L Ĺ H H H $

* $ L L Ĥ H H $

* $ L L H H Ĥ $

$ L L H Ĥ H $

Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

*	$	Ĺ	L	H	H	H	$
*	$	L	Ĺ	H	H	H	$
*	$	L	L	Ḧ	H	H	$
*	$	L	L	H	H	Ḧ	$
	$	L	L	H	Ḧ	H	$

Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

*	$	Ĺ	L	H	H	H	$
*	$	L	Ĺ	H	H	H	$
*	$	L	L	Ĥ	H	H	$
*	$	L	L	H	H	Ĥ	$
	$	L	L	H	Ĥ	H	$

Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

*	$	Ĺ	L	H	H	H	$
*	$	L	Ĺ	H	H	H	$
*	$	L	L	Ḧ	H	H	$
*	$	L	L	H	H	Ḧ	$
	$	L	L	H	Ḧ	H	$

Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

* $ Ĺ L H H H $
* $ L Ĺ H H H $
* $ L L Ĥ H H $
* $ L L H H Ĥ $
$ L L H Ĥ H $

Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

* $ Ĺ L H H H $
* $ L Ĺ H H H $
* $ L L H́ H H $
* $ L L H H H́ $
$ L L H H́ H $

Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

* $ Ĺ L H H H $
* $ L Ĺ H H H $
* $ L L Ĥ H H $
* $ L L H H Ĥ $
$ L L H Ĥ H $

Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

* $ Ĺ L H H H $

* $ L Ĺ H H H $

* $ L L Ĥ H H $

* $ L L H H Ĥ $

$ L L H Ĥ H $

Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

* $ Ĺ L H H H $

* $ L Ĺ H H H $

* $ L L Ĥ H H $

* $ L L H H Ĥ $

$ L L H Ĥ H $

Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

* $ Ĺ L H H H $
* $ L Ĺ H H H $
* $ L L Ĥ H H $
* $ L L H H Ĥ $
$ L L H Ĥ H $

Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

* $ Ĺ L H H H $
* $ L Ĺ H H H $
* $ L L Ĥ H H $
* $ L L H H Ĥ $
$ L L H Ĥ H $

Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

* $ Ĺ L H H H $
* $ L Ĺ H H H $
* $ L L Ĥ H H $
* $ L L H H Ĥ $
$ L L H Ĥ H $

Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

* $ Ĺ L H H H $
* $ L Ĺ H H H $
* $ L L Ĥ H H $
* $ L L H H Ĥ $
$ L L H Ĥ H $

Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

* $ Ĺ L H H H $
* $ L Ĺ H H H $
* $ L L Ĥ H H $
* $ L L H H Ĥ $
$ L L H Ĥ H $

Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

* $ Ĺ L H H H $
* $ L Ĺ H H H $
* $ L L Ĥ H H $
* $ L L H H Ĥ $
$ L L H Ĥ H $

Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

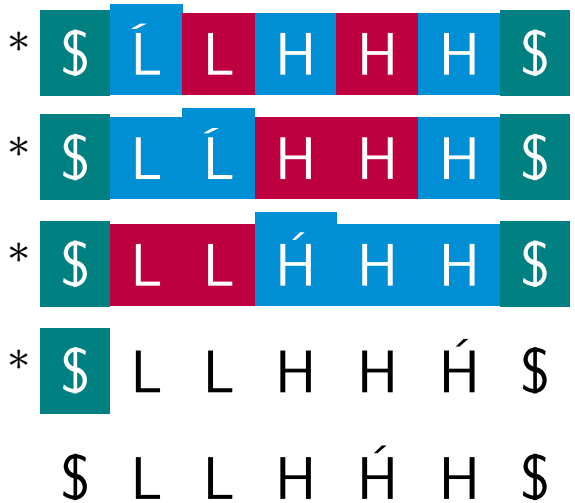
* $ Ĺ L H H H $
* $ L Ĺ H H H $
* $ L L Ĥ H H $
* $ L L H H Ĥ $
$ L L H Ĥ H $

Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

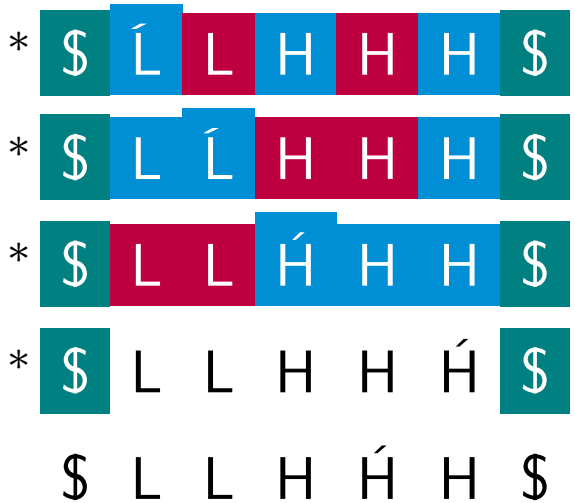


Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

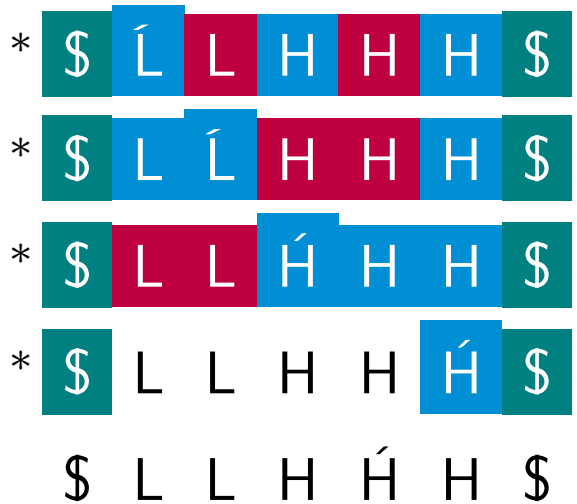


Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

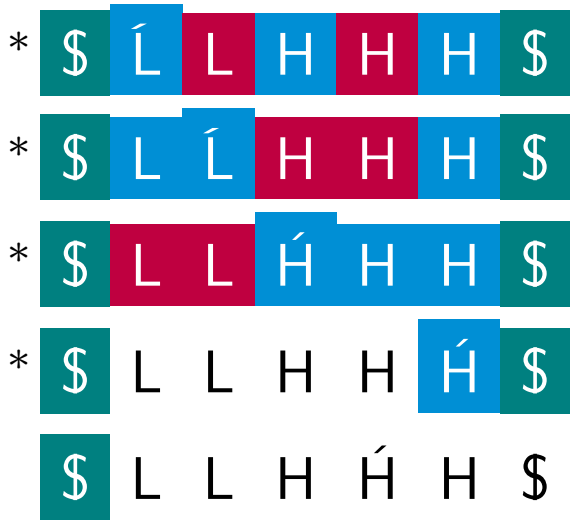


Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

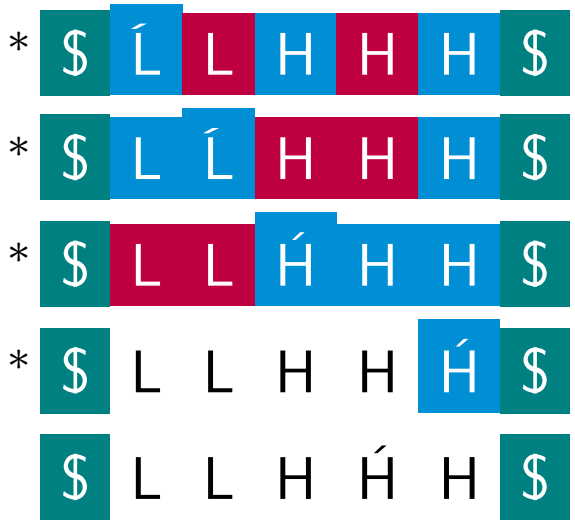


Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

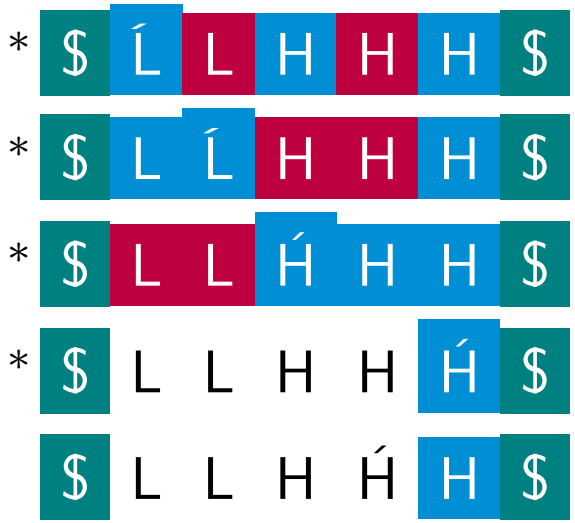


Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})

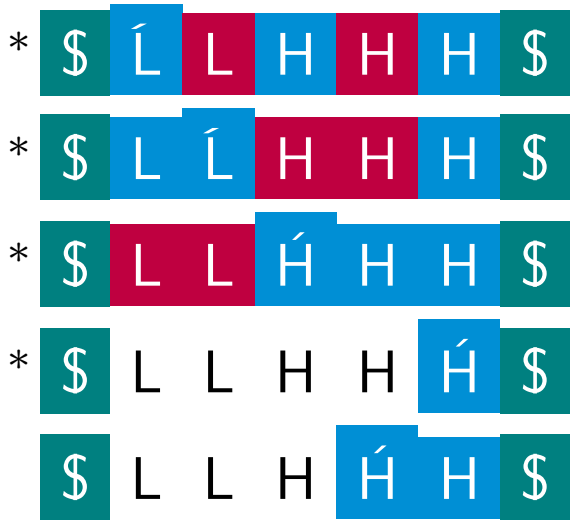


Non-Final RHOL

1. Stress the rightmost non-final heavy syllable, if it exists.
2. Otherwise, stress the leftmost (=first) syllable.

*X́HX
*XĹX
*XXX́

(X ∈ {H,L})



Bounded Tone Spreading

1. **Unbounded Tone Spreading in Copper Belt Bemba...**
   H spreads all the way to the right edge,...
2. **...With a Non-Local Inhibitor**
   ...but only 2 syllables if there is an H later on.

*	$	H	L	L	L	L	L	H	$
*	$	H	h	L	L	L	L	H	$
*	$	H	h	h	h	h	L	H	$
*	$	H	h	h	L	h	L	H	$
	$	H	h	h	L	L	L	H	$

Bounded Tone Spreading

1. **Unbounded Tone Spreading in Copper Belt Bemba...**
   H spreads all the way to the right edge,...
2. **...With a Non-Local Inhibitor**
   ...but only 2 syllables if there is an H later on.

*LXX
*XLX
*hhh

(X ∈ {H,L,h})

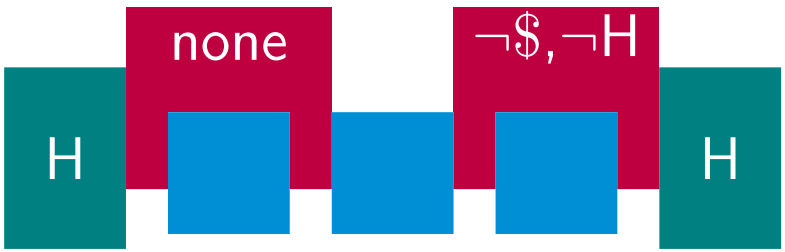
*	$	H	L	L	L	L	L	H	$
*	$	H	h	L	L	L	L	H	$
*	$	H	h	h	h	h	L	H	$
*	$	H	h	h	L	h	L	H	$
	$	H	h	h	L	L	L	H	$

Bounded Tone Spreading

1. **Unbounded Tone Spreading in Copper Belt Bemba...**
   H spreads all the way to the right edge,...
2. **...With a Non-Local Inhibitor**
   ...but only 2 syllables if there is an H later on.

*LXX
*XLX
*hhh

(X ∈ {H,L,h})



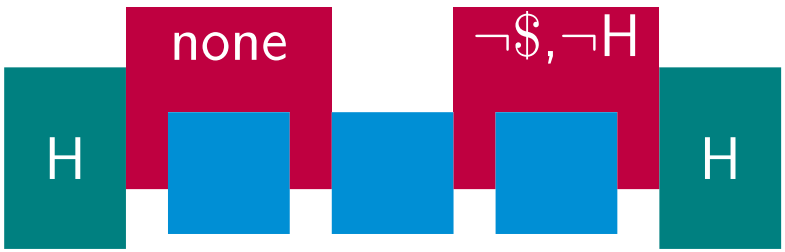
*	$	H	L	L	L	L	L	H	$
*	$	H	h	L	L	L	L	H	$
*	$	H	h	h	h	h	L	H	$
*	$	H	h	h	L	h	L	H	$
	$	H	h	h	L	L	L	H	$

Bounded Tone Spreading

1. **Unbounded Tone Spreading in Copper Belt Bemba...**
   H spreads all the way to the right edge,...
2. **...With a Non-Local Inhibitor**
   ...but only 2 syllables if there is an H later on.

*LXX
*XLX
*hhh

(X ∈ {H,L,h})



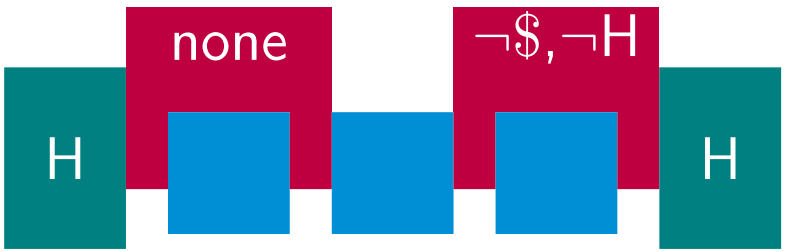
*	$	H	L	L	L	L	L	H	$
*	$	H	h	L	L	L	L	H	$
*	$	H	h	h	h	h	L	H	$
*	$	H	h	h	L	h	L	H	$
	$	H	h	h	L	L	L	H	$

Bounded Tone Spreading

1. **Unbounded Tone Spreading in Copper Belt Bemba...**
   H spreads all the way to the right edge,...
2. **...With a Non-Local Inhibitor**
   ...but only 2 syllables if there is an H later on.

*LXX
*XLX
*hhh

(X ∈ {H,L,h})



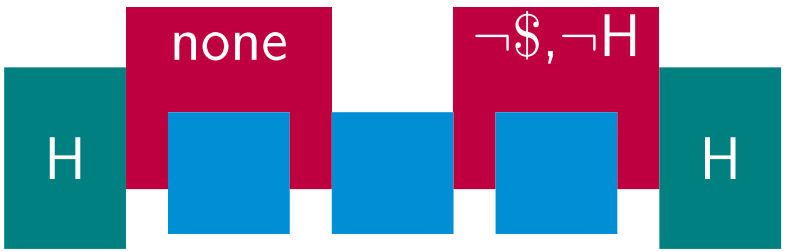
*	$	H	L	L	L	L	L	H	$
*	$	H	h	L	L	L	L	H	$
*	$	H	h	h	h	h	L	H	$
*	$	H	h	h	L	h	L	H	$
	$	H	h	h	L	L	L	H	$

Bounded Tone Spreading

1. **Unbounded Tone Spreading in Copper Belt Bemba...**
   H spreads all the way to the right edge,...
2. **...With a Non-Local Inhibitor**
   ...but only 2 syllables if there is an H later on.

*LXX
*XLX
*hhh

(X ∈ {H,L,h})



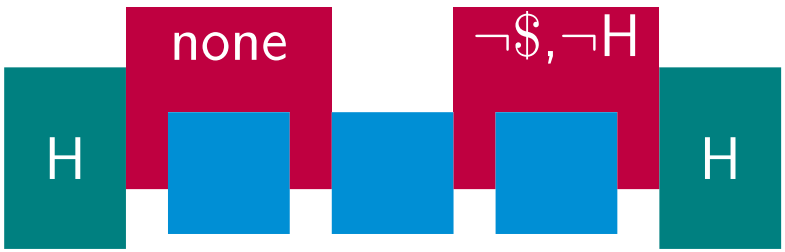
*	$	H	L	L	L	L	L	H	$
*	$	H	h	L	L	L	L	H	$
*	$	H	h	h	h	h	L	H	$
*	$	H	h	h	L	h	L	H	$
	$	H	h	h	L	L	L	H	$

Bounded Tone Spreading

1. **Unbounded Tone Spreading in Copper Belt Bemba...**
   H spreads all the way to the right edge,...
2. **...With a Non-Local Inhibitor**
   ...but only 2 syllables if there is an H later on.

*LXX
*XLX
*hhh

(X ∈ {H,L,h})



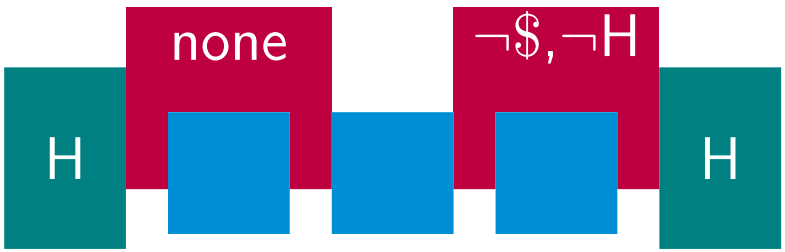
*	$	H	L	L	L	L	L	H	$
*	$	H	h	L	L	L	L	H	$
*	$	H	h	h	h	h	L	H	$
*	$	H	h	h	L	h	L	H	$
	$	H	h	h	L	L	L	H	$

Bounded Tone Spreading

1. **Unbounded Tone Spreading in Copper Belt Bemba...**
   H spreads all the way to the right edge,...
2. **...With a Non-Local Inhibitor**
   ...but only 2 syllables if there is an H later on.

*LXX
*XLX
*hhh

(X ∈ {H,L,h})



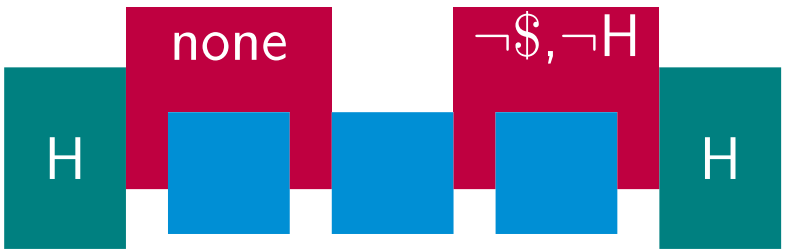
*	$	H	L	L	L	L	L	H	$
*	$	H	h	L	L	L	L	H	$
*	$	H	h	h	h	h	L	H	$
*	$	H	h	h	L	h	L	H	$
	$	H	h	h	L	L	L	H	$

Bounded Tone Spreading

1. **Unbounded Tone Spreading in Copper Belt Bemba...**
   H spreads all the way to the right edge,...
2. **...With a Non-Local Inhibitor**
   ...but only 2 syllables if there is an H later on.

*LXX
*XLX
*hhh

(X ∈ {H,L,h})



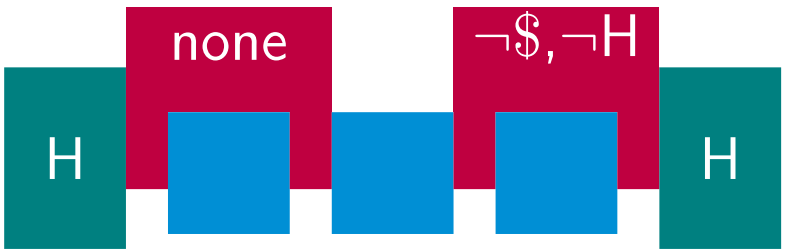
*	$	H	L	L	L	L	L	H	$
*	$	H	h	L	L	L	L	H	$
*	$	H	h	h	h	h	L	H	$
*	$	H	h	h	L	h	L	H	$
	$	H	h	h	L	L	L	H	$

Bounded Tone Spreading

1. **Unbounded Tone Spreading in Copper Belt Bemba...**
   H spreads all the way to the right edge,...
2. **...With a Non-Local Inhibitor**
   ...but only 2 syllables if there is an H later on.

*LXX
*XLX
*hhh

(X ∈ {H,L,h})



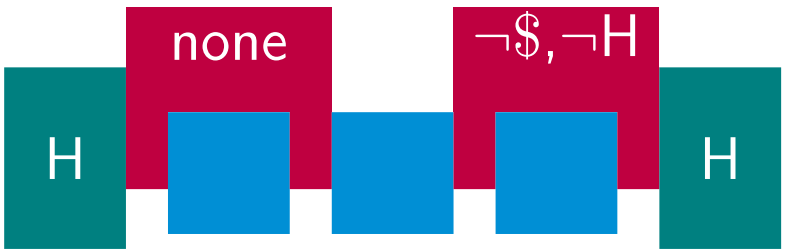
*	$	H	L	L	L	L	H	$
*	$	H	h	L	L	L	H	$
*	$	H	h	h	h	h	L	H	$
*	$	H	h	h	L	h	L	H	$
	$	H	h	h	L	L	L	H	$

Bounded Tone Spreading

1. **Unbounded Tone Spreading in Copper Belt Bemba...**
   H spreads all the way to the right edge,...
2. **...With a Non-Local Inhibitor**
   ...but only 2 syllables if there is an H later on.

*LXX
*XLX
*hhh

(X ∈ {H,L,h})



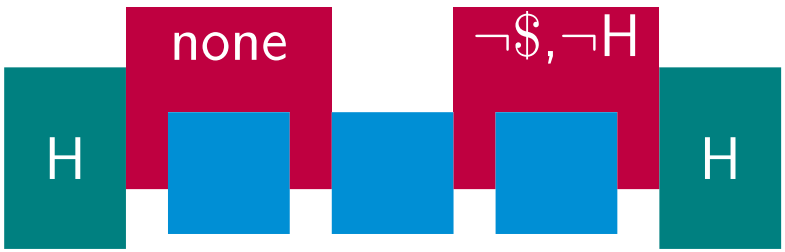
*	$	H	L	L	L	L	H	$
*	$	H	h	L	L	L	H	$
*	$	H	h	h	h	h	L	H	$
*	$	H	h	h	L	h	L	H	$
	$	H	h	h	L	L	L	H	$

Bounded Tone Spreading

1. **Unbounded Tone Spreading in Copper Belt Bemba...**
   H spreads all the way to the right edge,...
2. **...With a Non-Local Inhibitor**
   ...but only 2 syllables if there is an H later on.

*LXX
*XLX
*hhh

(X ∈ {H,L,h})



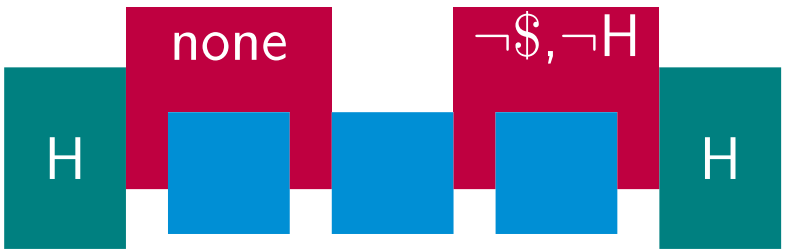
*	$	H	L	L	L	L	H	$
*	$	H	h	L	L	L	H	$
*	$	H	h	h	h	h	H	$
*	$	H	h	h	L	h	H	$
	$	H	h	h	L	L	H	$

Bounded Tone Spreading

1. **Unbounded Tone Spreading in Copper Belt Bemba...**
   H spreads all the way to the right edge,...
2. **...With a Non-Local Inhibitor**
   ...but only 2 syllables if there is an H later on.

*LXX
*XLX
*hhh

(X ∈ {H,L,h})



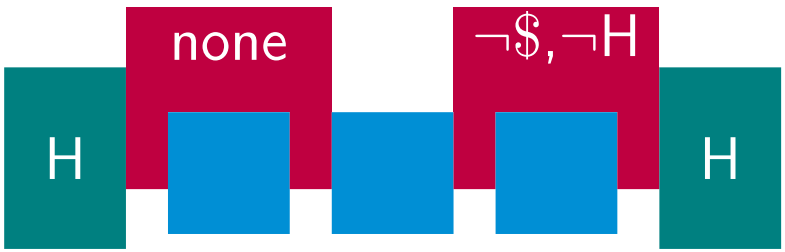
*	$	H	L	L	L	L	H	$
*	$	H	h	L	L	L	H	$
*	$	H	h	h	h	L	H	$
*	$	H	h	h	L	h	L	H	$
	$	H	h	h	L	L	L	H	$

Bounded Tone Spreading

1. **Unbounded Tone Spreading in Copper Belt Bemba...**
   H spreads all the way to the right edge,...
2. **...With a Non-Local Inhibitor**
   ...but only 2 syllables if there is an H later on.

*LXX
*XLX
*hhh

(X ∈ {H,L,h})



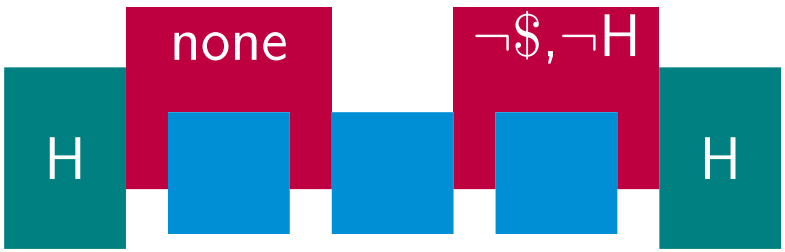
*	$	H	L	L	L	L	H	$
*	$	H	h	L	L	L	H	$
*	$	H	h	h	h	L	H	$
*	$	H	h	h	L	h	L	H	$
	$	H	h	h	L	L	L	H	$

Bounded Tone Spreading

1. **Unbounded Tone Spreading in Copper Belt Bemba...**
   H spreads all the way to the right edge,...
2. **...With a Non-Local Inhibitor**
   ...but only 2 syllables if there is an H later on.

*LXX
*XLX
*hhh

(X ∈ {H,L,h})



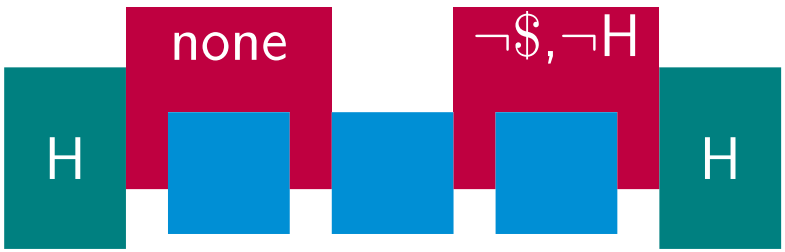
* $ H L L L L L H $
* $ H h L L L L H $
* $ H h h h h L H $
* $ H h h L h L H $
$ H h h L L L H $

Bounded Tone Spreading

1. **Unbounded Tone Spreading in Copper Belt Bemba...**
   H spreads all the way to the right edge,...
2. **...With a Non-Local Inhibitor**
   ...but only 2 syllables if there is an H later on.

*LXX
*XLX
*hhh

(X ∈ {H,L,h})



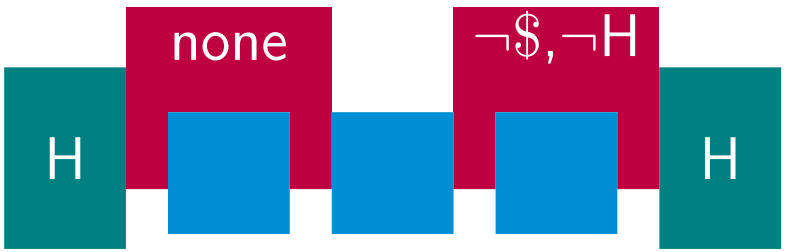
*	$	H	L	L	L	L	H	$
*	$	H	h	L	L	L	H	$
*	$	H	h	h	h	L	H	$
*	$	H	h	h	L	h	L	H	$
	$	H	h	h	L	L	L	H	$

Bounded Tone Spreading

1. **Unbounded Tone Spreading in Copper Belt Bemba...**
   H spreads all the way to the right edge,...
2. **...With a Non-Local Inhibitor**
   ...but only 2 syllables if there is an H later on.

*LXX
*XLX
*hhh

(X ∈ {H,L,h})



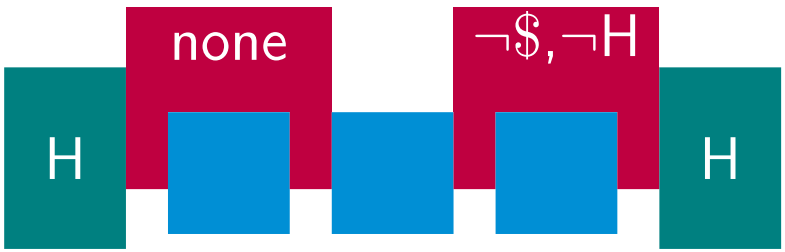
*	$	H	L	L	L	L	H	$
*	$	H	h	L	L	L	H	$
*	$	H	h	h	h	L	H	$
*	$	H	h	h	L	L	H	$
	$	H	h	h	L	L	H	$

Bounded Tone Spreading

1. **Unbounded Tone Spreading in Copper Belt Bemba...**
   H spreads all the way to the right edge,...
2. **...With a Non-Local Inhibitor**
   ...but only 2 syllables if there is an H later on.

*LXX
*XLX
*hhh

(X ∈ {H,L,h})



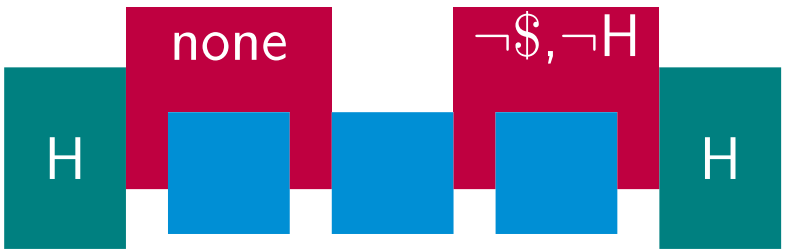
*	$	H	L	L	L	L	H	$
*	$	H	h	L	L	L	H	$
*	$	H	h	h	h	L	H	$
*	$	H	h	h	L	h	H	$
	$	H	h	h	L	L	H	$

Bounded Tone Spreading

1. **Unbounded Tone Spreading in Copper Belt Bemba...**
   H spreads all the way to the right edge,...
2. **...With a Non-Local Inhibitor**
   ...but only 2 syllables if there is an H later on.

*LXX
*XLX
*hhh

(X ∈ {H,L,h})



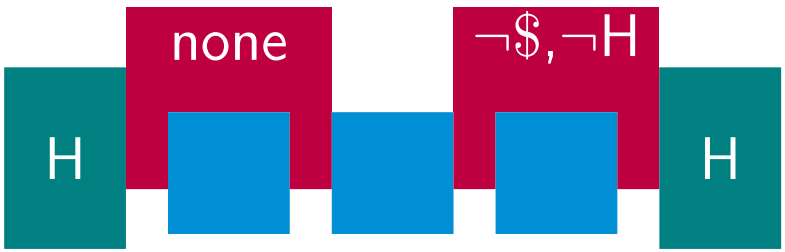
*	$	H	L	L	L	L	H	$
*	$	H	h	L	L	L	H	$
*	$	H	h	h	h	L	H	$
*	$	H	h	h	L	L	H	$
	$	H	h	h	L	L	H	$

Bounded Tone Spreading

1. **Unbounded Tone Spreading in Copper Belt Bemba...**
   H spreads all the way to the right edge,...
2. **...With a Non-Local Inhibitor**
   ...but only 2 syllables if there is an H later on.

*LXX
*XLX
*hhh

(X ∈ {H,L,h})



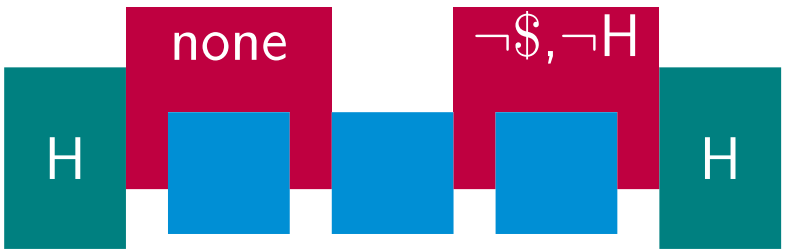
*	$	H	L	L	L	L	H	$
*	$	H	h	L	L	L	H	$
*	$	H	h	h	h	L	H	$
*	$	H	h	h	L	h	H	$
	$	H	h	h	L	L	H	$

Bounded Tone Spreading

1. **Unbounded Tone Spreading in Copper Belt Bemba...**
   H spreads all the way to the right edge,...
2. **...With a Non-Local Inhibitor**
   ...but only 2 syllables if there is an H later on.

*LXX
*XLX
*hhh

(X ∈ {H,L,h})



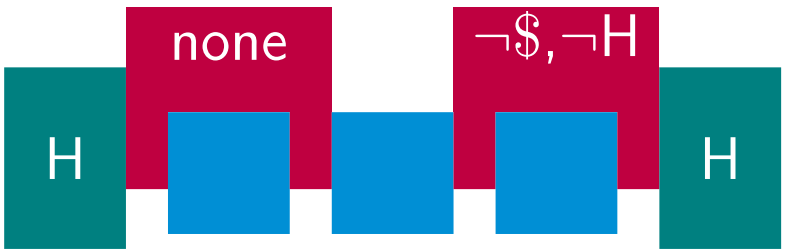
*	$	H	L	L	L	L	H	$
*	$	H	h	L	L	L	H	$
*	$	H	h	h	h	L	H	$
*	$	H	h	h	L	h	H	$
	$	H	h	h	L	L	H	$

Bounded Tone Spreading

1. **Unbounded Tone Spreading in Copper Belt Bemba...**
   H spreads all the way to the right edge,...
2. **...With a Non-Local Inhibitor**
   ...but only 2 syllables if there is an H later on.

*LXX
*XLX
*hhh

(X ∈ {H,L,h})



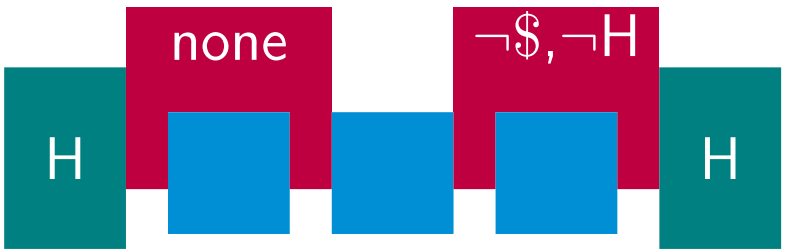
*	$	H	L	L	L	L	H	$
*	$	H	h	L	L	L	H	$
*	$	H	h	h	h	L	H	$
*	$	H	h	h	L	h	H	$
	$	H	h	h	L	L	H	$

Bounded Tone Spreading

1. **Unbounded Tone Spreading in Copper Belt Bemba...**
   H spreads all the way to the right edge,...
2. **...With a Non-Local Inhibitor**
   ...but only 2 syllables if there is an H later on.

*LXX
*XLX
*hhh

(X ∈ {H,L,h})



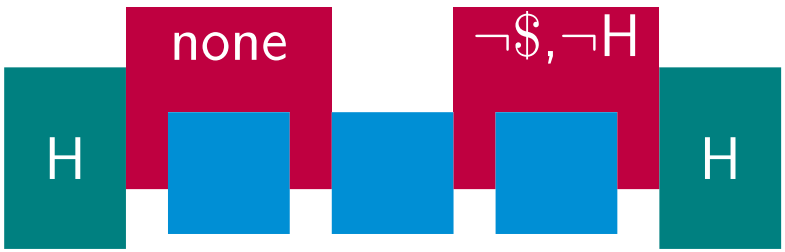
*	$	H	L	L	L	L	H	$
*	$	H	h	L	L	L	H	$
*	$	H	h	h	h	L	H	$
*	$	H	h	h	L	h	H	$
	$	H	h	h	L	L	H	$

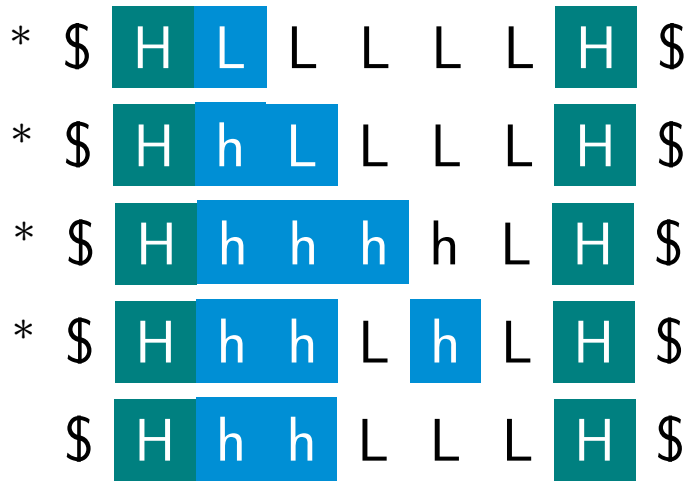
Bounded Tone Spreading

1. **Unbounded Tone Spreading in Copper Belt Bemba...**
   H spreads all the way to the right edge,...
2. **...With a Non-Local Inhibitor**
   ...but only 2 syllables if there is an H later on.

*LXX
*XLX
*hhh

(X ∈ {H,L,h})





Danger, Will Robinson! Overgeneration!

- IBSP needs more fine-grained intervals.
- But this easily leads to typological overgeneration.

Danger, Will Robinson! Overgeneration!

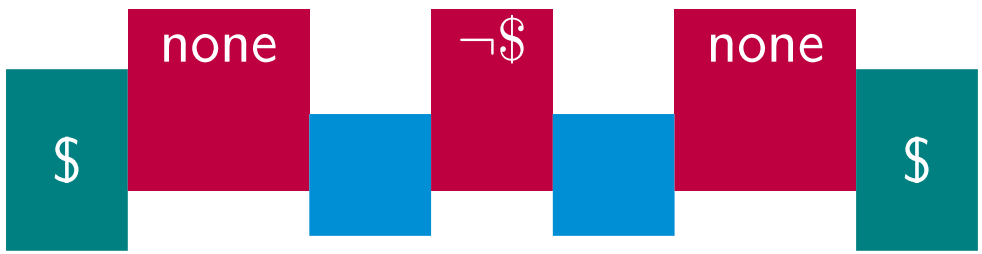
- IBSP needs more fine-grained intervals.
- But this easily leads to typological overgeneration.

*sʃ
*ʃs

Danger, Will Robinson! Overgeneration!

- IBSP needs more fine-grained intervals.
- But this easily leads to typological overgeneration.

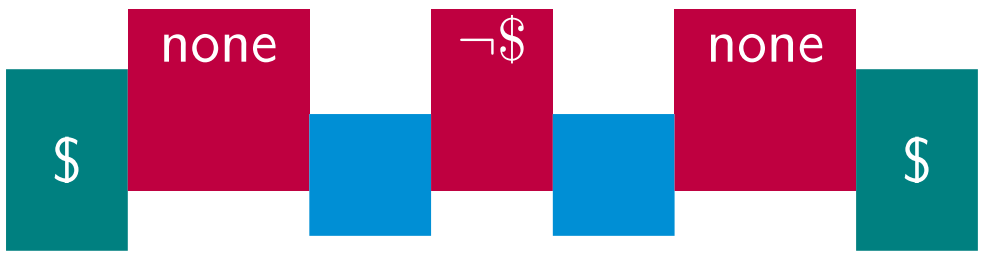
*s∫
*∫s



Danger, Will Robinson! Overgeneration!

- IBSP needs more fine-grained intervals.
- But this easily leads to typological overgeneration.

*sʃ
*ʃs



- This produces **First-Last harmony (FLH)**, which is **unattested**.

Proposal: k-Vals Must be c-Command-Like

- What separates FLH from the attested cases?
- k-val for FLH relaxes locality, then tightens it again (local + non-local + local)
- Attested cases are of the form
  - local + non-local, or
  - non-local + local
- This is similar to **c-command**.

c-Command as Local + Non-Local

x c-commands y (in a strictly binary branching tree) iff

local x has a sister z, and

non-local z reflexively dominates y.

Deepening the Connnection: Monotonicity

Ban On Improper Locality

Within a k-val, the degree of locality must be

- monotonically increasing, or
- monotonically decreasing.

- **Monotonicity in syntax**
  - Subcategorization $<$ A-Move $<$ A′-Move
  - Once you've undergone a higher operation, you can't participate in lower ones anymore.
- **Monotonicity in morphology**
  - *ABA follows from monotonicity.
- **Monotonicity in semantics**
  - Everywhere...

Summary

- SP bans subsequences $\Rightarrow$ no locality at all
- Adding locality domains to SP greatly increases its power.
- But IBSP with simple k-vals is still too weak.
- Adding c-command-like locality domains
  - grants enough expressivity
  - while avoiding overgeneration.

Main Predictions

- ***local + non-local + local (*LNL)**
  No unbounded dependency between local "clusters"
- ***non-local + local + non-local (*NLN)**
  No local "cluster" within interval dependency

Next Steps

1. Test the predictions against the full typology.
2. Explore the syntax column.
3. Go beyond monotonicity in deriving the limitation.

References I

Applegate, Richard B. 1972. *Ineseño Chumash grammar*. Doctoral Dissertation, University of California, Berkeley.

Baek, Hyunah. 2017. Computational representation of unbounded stress: Tiers with structural features. Ms., Stony Brook University; to appear in *Proceedings of CLS 53*.

Bickmore, Lee S., and Nancy C. Kula. 2013. Ternary spreading and the OCP in Copperbelt Bemba. *Studies in African Linguistics* 42.

Chandlee, Jane. 2014. *Strictly local phonological processes*. Doctoral Dissertation, University of Delaware. URL `http://udspace.udel.edu/handle/19716/13374`.

Graf, Thomas. 2017. The power of locality domains in phonology. *Phonology* 34:1–21. URL `https://dx.doi.org/10.1017/S0952675717000197`, in press.

Hayes, Bruce. 1995. *Metrical stress theory*. Chicago: Chicago University Press.

Heinz, Jeffrey. 2009. On the role of locality in learning stress patterns. *Phonology* 26:303–351. URL `https://doi.org/10.1017/S0952675709990145`.

Heinz, Jeffrey. 2010. Learning long-distance phonotactics. *Linguistic Inquiry* 41:623–661. URL `http://dx.doi.org/10.1162/LING_a_00015`.

Heinz, Jeffrey, Chetan Rawal, and Herbert G. Tanner. 2011. Tier-based strictly local constraints in phonology. In *Proceedings of the 49th Annual Meeting of the Association for Computational Linguistics*, 58–64. URL `http://www.aclweb.org/anthology/P11-2011`.

References II

Hyman, Larry. 2011. Tone: Is it different? In *The blackwell handbook of phonological theory*, ed. John A. Godlsmith, Jason Riggle, and Alan C. L. Yu, 197–238. Wiley.

Jardine, Adam. 2016. Computationally, tone is different. *Phonology* 33:247–283. URL `https://doi.org/10.1017/S0952675716000129`.

McMullin, Kevin. 2016. *Tier-based locality in long-distance phonotactics: Learnability and typology*. Doctoral Dissertation, Uniersity of British Columbia.

Stanton, Juliet. 2016. Latin *-alis*/*-aris* and segmental blocking in dissimilation. Ms., MIT.