

# Bidirectional Stress Systems

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## Bidirectional stress systems

- Anchor one foot at one edge and orient remaining feet towards the opposite edge.
- Creates an Internal lapse configuration in odd-parity forms.

### (1) Bidirectional trochaic footing

- |                                  |                                  |
|----------------------------------|----------------------------------|
| a. (σσ)(σσ)(σσ)<br>(σσ)σ(σσ)(σσ) | b. (σσ)(σσ)(σσ)<br>(σσ)(σσ)σ(σσ) |
|----------------------------------|----------------------------------|

### (2) Bidirectional iambic footing

- |                                  |                                  |
|----------------------------------|----------------------------------|
| a. (σσ)(σσ)(σσ)<br>(σσ)σ(σσ)(σσ) | b. (σσ)(σσ)(σσ)<br>(σσ)(σσ)σ(σσ) |
|----------------------------------|----------------------------------|

## The bidirectional typology

- Bidirectional systems are always trochaic.

## Proposed analysis

- INITIAL GRIDMARK (Prince 1983) and NONFINALITY (Prince and Smolenksy 1993) are the only constraints that can introduce lapse in binary systems.

- (4) a. INITIAL GRIDMARK: A foot-level gridmark occurs over the initial syllable of a prosodic word.
- b. NONFINALITY: No foot-level gridmark occurs over the final syllable of a prosodic word.

### (5) The basic schema

	INITIAL GM	NONFINALITY	PERF ALT
☞ a. $\begin{matrix} x & & x & & x \\ x & x & x & x & x & x & x \\ \sigma & \sigma & \sigma & \sigma & \sigma & \sigma & \sigma \end{matrix}$			*
☞ b. $\begin{matrix} x & & x & & x \\ x & x & x & x & x & x & x \\ \sigma & \sigma & \sigma & \sigma & \sigma & \sigma & \sigma \end{matrix}$			*
c. $\begin{matrix} & x & & x & & x \\ x & x & x & x & x & x & x \\ \sigma & \sigma & \sigma & \sigma & \sigma & \sigma & \sigma \end{matrix}$	*!		
d. $\begin{matrix} x & & x & & x & & x \\ x & x & x & x & x & x & x \\ \sigma & \sigma & \sigma & \sigma & \sigma & \sigma & \sigma \end{matrix}$		*!	
e. $\begin{matrix} & x & & x & & x \\ x & x & x & x & x & x & x \\ \sigma & \sigma & \sigma & \sigma & \sigma & \sigma & \sigma \end{matrix}$	*!	*!	*
f. $\begin{matrix} & x & & x & & x \\ x & x & x & x & x & x & x \\ \sigma & \sigma & \sigma & \sigma & \sigma & \sigma & \sigma \end{matrix}$	*!	*!	*

- Trochaic bidirectional patterns (5a,b) satisfy INITIAL GRIDMARK and NONFINALITY but violate PERFECT ALTERNATION.
- Perfect alternation patterns (5c,d) violate INITIAL GRIDMARK or NONFINALITY but satisfy PERFECT ALTERNATION.
- Iambic bidirectional patterns (5e,f) violate INITIAL GRIDMARK, NONFINALITY, and PERFECT ALTERNATION.
  - Harmonically bounded by (5c,d).

## Part I: An Iambic-Trochaic Asymmetry

### First line of evidence

- All languages described as having a bidirectional pattern are trochaic.
- (6) Trochaic languages with bidirectional patterns
- |                          |                                |
|--------------------------|--------------------------------|
| a. (σσ)σ(σσ)(σσ)         | b. (σσ)(σσ)σ(σσ)               |
| Garawa (Furby 1974)      | Lenakel verbs (Lynch 1978)     |
| Indonesian (Cohn 1989)   | Piro (Matteson 1965)           |
| Norwegian (Lorentz 1996) | Polish (Rubach and Booij 1985) |
| Spanish (Harris 1983)    |                                |
- (7) Iambic languages with bidirectional patterns
- |                   |                   |
|-------------------|-------------------|
| a. (σσ)σ(σσ)(σσ)  | b. (σσ)(σσ)σ(σσ)  |
| <i>Unattested</i> | <i>Unattested</i> |

### Spanish

- Kager (2001): Initial dactyls derived rather than basic.
    - They only occur when a clitic precedes a word with initial secondary stress (Roca 1986).
  - Reply: Native speakers confirm Harris's (1983) description of the initial dactyl pattern as the basic pattern of colloquial Spanish.
- (8) Initial dactyls in Spanish
- gènerativo
  - bùrocratización
  - nàturalísta
  - nàturalización
  - ràcionalísta
  - ràcionalización
  - gràmaticàlidad



## Part II: The Proposed Analysis

### Proposal

- Lapse emerges *only* when INITIAL GRIDMARK or NONFINALITY dominates the constraints that require perfect binary alternation.
- The remaining constraints must all promote perfect alternation.
  - Adopt Hyde 2001, 2002 framework.
  - Modify standard structural assumptions (Itô and Mester 1992, McCarthy and Prince 1993)
- For similar approach in a grid-only framework, see Gordon 2002.

#### (12) Garawa-type bidirectional pattern

##### a. Proposed structure

x		x		x		
x	x	x	x	x	x	x
σ	σ	σ	σ	σ	σ	σ
	/	/	/			

##### b. Standard structure

( $\acute{\sigma}$ σ)σ( $\acute{\sigma}$ σ)( $\acute{\sigma}$ σ)

#### (13) Piro-type bidirectional pattern

##### a. Proposed structure

x		x		x		
x	x	x	x	x	x	x
σ	σ	σ	σ	σ	σ	σ
/	/	/	/	/	/	/

##### b. Standard structure

( $\acute{\sigma}$ σ)( $\acute{\sigma}$ σ)σ( $\acute{\sigma}$ σ)

### Differences

- Proposed: Requires exhaustive parsing of syllables into feet (Selkirk 1984).
  - Standard: Allows unparsed syllables (Itô and Mester 1992).
- Proposed: Allows stressless feet.
  - Standard: Requires every foot to have a stressed syllable (Selkirk 1980).
- Proposed: Allows feet to overlap.
  - Standard: Requires proper bracketing (Itô and Mester 1992).
- Proposed: Distinguishes between heads and gridmarks.
  - Standard: Either assumes that gridmarks are heads (Hayes 1995) or dispenses with metrical grid altogether (Crowhurst 1996).

#### (14) Perfect alternation constraints

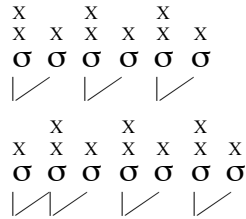
- a. MAPGRIDMARK: A foot-level gridmark occurs within the domain of every foot.
- b. \*CLASH: For any two entries on level  $n + 1$  of the grid there is an intervening entry on level  $n$ .
- c. PRWD-L: The left edge of every prosodic word is aligned with the left edge of some foot-head.
- d. PRWD-R: The right edge of every prosodic word is aligned with the right edge of some foot-head.
- e. HDS-L: The left edge of every foot-head is aligned with the left edge of some prosodic word.
- f. HDS-R: The right edge of every foot-head is aligned with the right edge of some prosodic word.

**Perfect alternation**

- Given the proposed structural assumptions, the constraints in (14) can only produce the perfect alternation patterns in (15) and (16).
- Each of the perfect alternation patterns is attested.

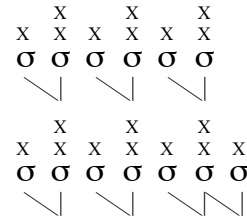
(15) Minimal alternation

a. Trochaic



Nengone (Tryon 1967)

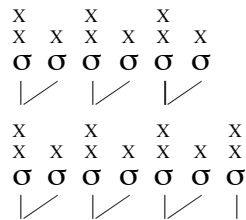
b. Iambic



Araucanian (Echeverria and Contreras 1965)

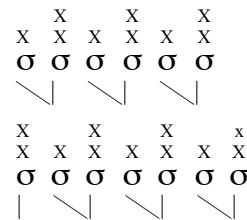
(16) Maximal alternation

a. Trochaic



Maranungku (Tryon 1970)

b. Iambic



Suruwaha (Everett 1996a)

**Without INITIAL GRIDMARK and NONFINALITY**

- Perfect alternation harmonically bounds patterns with lapse (or clash), including the bidirectional patterns.

**Overlapping feet**

- Allow every foot to be stressed without creating clash.
- Allow minimal alternation patterns to harmonically bound variants.

(17) Trochaic minimal alternation (17a) harmonically bounds Garawa-type bidirectional pattern (17b)

σσσσσσσ	HDS-L	*CLASH	MAPGM
<p>a.</p> <pre> x   x   x x x x x x x σ σ σ σ σ σ   /   /   / </pre>	* **		
<p>b.</p> <pre> x   x   x x x x x x x σ σ σ σ σ σ     /   /   / </pre>	* **		*!
<p>c.</p> <pre> x x   x   x x x x x x x σ σ σ σ σ σ   /   /   / </pre>	* **	*!	

(18) Iambic minimal alternation (18a) harmonically bounds AntiGarawa-type bidirectional pattern (18b)

σσσσσσσ	HDS-R	*CLASH	MAPGM
a.    x        x        x x x   x x   x x   x σ σ   σ σ   σ σ   σ / \   / \   / \   / \	* * * * *		
b.    x        x        x x x   x x   x x   x σ σ   σ σ   σ σ   σ / \   / \   / \   / \	* * * * *		*!
c.    x        x        x x x x   x x   x x   x σ σ   σ σ   σ σ   σ / \   / \   / \   / \	* * * * *	*!	

**Conflicting alignment**

- Spreads head syllables as far apart as possible.
  - Head syllables may not occur more than one syllable apart, due to nonviolable HeadGap condition (Hyde 2002).
- Allows every foot to be stressed without creating a clash.
  - Negates the advantage of overlapping feet.
- Allows maximal alternation to harmonically bound its variants.

(19) Trochaic maximal alternation (19a) harmonically bounds Piro-type bidirectional pattern (19b)

σσσσσσσ	PRWD-L	HDS-R	*CLASH	MAPGM
a.    x        x        x        x x x   x x   x x   x x σ σ   σ σ   σ σ   σ σ / \   / \   / \   / \		** * * * * * * * * * *		
b.    x        x        x x x   x x   x x   x σ σ   σ σ   σ σ   σ / \   / \   / \   / \		* * * * * * * * * * * *!		
c.    x        x        x x x x   x x   x x   x σ σ   σ σ   σ σ   σ / \   / \   / \   / \		* * * * * * * * * * * *!	*!	
d.    x        x        x x x   x x   x x   x σ σ   σ σ   σ σ   σ / \   / \   / \   / \		** * * * * * * * * * *		*!

(20) Iambic maximal alternation (20a) harmonically bounds AntiPiro-type bidirectional pattern (20b)

σσσσσσσ	PRWD-R	HDS-L	*CLASH	MAPGM
a. $\begin{array}{cccc} x & & x & & x & & x \\ x & x & x & x & x & x & x \\ \sigma & \sigma & \sigma & \sigma & \sigma & \sigma & \sigma \end{array}$ $\begin{array}{cccc}   & \diagdown &   & \diagdown &   & \diagdown &   \end{array}$		** ***** *****		
b. $\begin{array}{cccc} & & x & & & & x \\ x & x & x & x & x & x & x \\ \sigma & \sigma & \sigma & \sigma & \sigma & \sigma & \sigma \end{array}$ $\begin{array}{cccc} \diagdown & \diagdown & \diagdown & \diagdown & \diagdown & \diagdown & \diagdown \end{array}$		* ** ***** *****!		
c. $\begin{array}{cccc} & & x & x & & & x \\ x & x & x & x & x & x & x \\ \sigma & \sigma & \sigma & \sigma & \sigma & \sigma & \sigma \end{array}$ $\begin{array}{cccc} \diagdown &   & \diagdown &   & \diagdown &   & \diagdown \end{array}$		* ** ***** *****!	*!	
d. $\begin{array}{cccc} & & & & x & & x \\ x & x & x & x & x & x & x \\ \sigma & \sigma & \sigma & \sigma & \sigma & \sigma & \sigma \end{array}$ $\begin{array}{cccc}   & \diagdown &   & \diagdown &   & \diagdown &   \end{array}$		** ***** *****		*!

**With INITIAL GRIDMARK and NONFINALITY**

- Trochaic bidirectional patterns no longer harmonically bounded.
- Iambic bidirectional patterns still harmonically bounded.

(21) Trochaic Garawa-type bidirectional pattern (21b) emerges with high-ranking INITIAL GRIDMARK

σσσσσσσ	INTGM	HDS-L	*CLASH	MAPGM
a. $\begin{array}{cccc} & & x & & x & & x \\ x & x & x & x & x & x & x \\ \sigma & \sigma & \sigma & \sigma & \sigma & \sigma & \sigma \end{array}$ $\begin{array}{cccc} \diagdown & \diagdown & \diagdown & \diagdown & \diagdown & \diagdown & \diagdown \end{array}$	*!	* *** *****		
b. $\begin{array}{cccc} x & & & & x & & x \\ x & x & x & x & x & x & x \\ \sigma & \sigma & \sigma & \sigma & \sigma & \sigma & \sigma \end{array}$ $\begin{array}{cccc}   & \diagdown &   & \diagdown &   & \diagdown &   \end{array}$		* *** *****		*
c. $\begin{array}{cccc} x & x & & & x & & x \\ x & x & x & x & x & x & x \\ \sigma & \sigma & \sigma & \sigma & \sigma & \sigma & \sigma \end{array}$ $\begin{array}{cccc}   & \diagdown &   & \diagdown &   & \diagdown &   \end{array}$		* *** *****	*!	

- (21a), trochaic minimal alternation, can be found in Nengone (Tryon 1967).
  - HDS-L, MAPGRIDMARK, \*CLASH >> INITIAL GRIDMARK
- (21b) is the bidirectional pattern found in the (6a) languages.
  - INITIAL GRIDMARK, HDS-L, \*CLASH >> MAPGRIDMARK
- (21c) can be found in Passamaquoddy (LeSourd 1993).
  - HDS-L, INITIAL GRIDMARK, MAPGRIDMARK >> \*CLASH

(22) Iambic AntiGarawa-type bidirectional pattern (22b) still harmonically bounded, even with INITIAL GRIDMARK

σσσσσσσ	INTGM	HDS-R	*CLASH	MAPGM
a.    x       x       x x x   x x   x x   x σ σ   σ σ   σ σ   σ / \   / \   / \   / \	*	* ** *****		
b.    x       x       x x x   x x   x x   x σ σ   σ σ   σ σ   σ / \   / \   / \   / \	*	* ** *****		*
c.    x       x       x x x x   x x   x x   x σ σ   σ σ   σ σ   σ / \   / \   / \   / \	*	* ** *****	*!	

- (22a), iambic minimal alternation, can be found in Araucanian (Echeverria and Contreras 1965)
  - Harmonically bounds variants.
- (22b), the iambic AntiGarawa-type bidirectional pattern, is unattested.
  - Harmonically bounded by (22a).
- (22c) is unattested.
  - Harmonically bounded by (22a).

(23) Trochaic Piro-type bidirectional pattern (23b) emerges with high-ranking NONFINALITY

σσσσσσσ	PRWD-L	NONFIN	*CLASH	MAPGM	HDS-R
a.    x       x       x       x x x   x x   x x   x x σ σ   σ σ   σ σ   σ σ / \   / \   / \   / \		*!			** ** *****
b.    x       x       x x x   x x   x x   x σ σ   σ σ   σ σ   σ / \   / \   / \   / \					* ** *****
c.    x       x       x x x x   x x   x x   x σ σ   σ σ   σ σ   σ / \   / \   / \   / \			*!		* ** *****
d.    x       x       x x x   x x   x x   x σ σ   σ σ   σ σ   σ / \   / \   / \   / \				*!	** ** *****

- (23a), trochaic maximal alternation, can be found in Maranungku (Tryon 1970).
  - PRWD-L >> HDS-R; HDS-R, MAPGRIDMARK >> NONFINALITY.
- (23b) is the bidirectional pattern of the languages in (6b).
  - PRWD-L, NONFINALITY, MAPGRIDMARK >> HDS-R.
- (23c) is unattested.
  - Harmonically bounded by (23b), due to the presence of \*CLASH.
- (23d) can be found in Pintupi (Hansen and Hansen 1969).
  - PRWD-L >> Hds-R; Hds-R, NONFINALITY >> MAPGRIDMARK.



(27) Ranking to establish minimal underparsing

FT-BIN >> PARSE-SYLL

(28) Ranking to establish a bidirectional system

(FT-BIN), ALIGN-L, ALIGN-R >> \*LAPSE, LAPSE-AT-END

(29) Creating internal lapse in trochaic systems

σσσσσσσ	ALIGN-L	ALIGN-R	*LAPSE	LAPSE-AT-END
a. (σ́σ)σ(σ́σ)(σ́σ)			*	*
b. (σ́σ)(σ́σ)σ(σ́σ)			*	*
c. (σ́σ)(σ́σ)(σ́σ)σ		*!	*	
d. σ(σ́σ)(σ́σ)(σ́σ)	*!			

(30) Creating internal lapse in iambic systems

σσσσσσσ	ALIGN-L	ALIGN-R	*LAPSE	LAPSE-AT-END
a. (σ́σ)σ(σ̀σ)(σ̀σ)			*	*
b. (σ́σ)(σ̀σ)σ(σ̀σ)			*	*
c. σ(σ́σ)(σ̀σ)(σ̀σ)	*!		*	*
d. (σ́σ)(σ̀σ)(σ̀σ)σ		*!		

### The location of lapse

- Determined by LAPSE-AT-PEAK and the position of the primary stress.

(31) LAPSE-AT-PEAK with head foot leftmost

a. Trochaic

(σ́σ)(σ̀σ)(σ̀σ)

(σ́σ)σ(σ̀σ)(σ̀σ)

b. Iambic

(σ́σ)(σ̀σ)(σ̀σ)

(σ́σ)σ(σ̀σ)(σ̀σ)

(32) LAPSE-AT-PEAK with head foot rightmost

a. Trochaic

(σ̀σ)(σ̀σ)(σ́σ)

(σ̀σ)(σ̀σ)σ(σ́σ)

b. Iambic

(σ̀σ)(σ̀σ)(σ́σ)

(σ̀σ)(σ̀σ)σ(σ́σ)

### First problem

- Lapse Licensing produces two iambic bidirectional patterns.
- Ignores the observation that iambic bidirectional patterns unattested.
  - No counterexamples and not disputed in the literature.

## Second problem

- Lapse Licensing designed to capture the mistaken claim that internal lapse always occurs next to primary stress.
  - Contradicted by initial dactyl patterns of Indonesian, Norwegian and Spanish.
- Undergeneration: Indonesian/Norwegian/Spanish pattern (33b) harmonically bounded by Piro/Polish/Lenakel pattern (33a).

(33) Harmonic bounding of initial dactyl with secondary stress

σσσσσσσ	ALGN-L	ALGN-R	*LPSE	LPSE-END	LPSE-PK
a. (̀σ)(̀σ)σ(́σ)			*	*	
b. (̀σ)σ(̀σ)(́σ)			*	*	*!

## Constraint Categoricity Hypothesis (McCarthy 2003)

- Relies heavily on Lapse Licensing's success to support claim that gradient Alignment is unnecessary.
- The undergeneration of Indonesian, Norwegian, and Spanish is problematic.
  - No obvious alternative to gradient Alignment.
- Khalka Mongolian (Walker 1997), Buriat Mongolian (Walker 1997), and Banawá (Buller, Buller and Everett 1993, Everett 1996a,b) also also problematic.
  - See Hyde 2007a for brief discussion.

## Asymmetrical Alignment (Alber 2005)

(34) Alber's characterization

The isolated foot in a bidirectional system is always the head foot, and it always occurs at the right edge of the prosodic word.

(35) Constraints for bidirectional systems

- ALLFEETL: The left edge of every foot is aligned with the left edge of a prosodic word.
- LEFTMOST: The left edge of every prosodic word coincides with the left edge of a head foot.
- RIGHTMOST: The right edge of every prosodic word coincides with the right edge of a head foot.

(36) Ranking to establish minimal underparsing

FT-BIN >> PARSE-SYLL >> ALLFEETL

(37) Ranking to establish a bidirectional system

RIGHTMOST >> ALLFEETL >> \*LAPSE

(38) Producing the trochaic Piro-type pattern

σσσσσσ	RIGHTMOST	ALLFEETL	*LAPSE
☞ a. (σ̀σ)(σ̀σ)σ(σ́σ)		** *****	*
b. σ(σ̀σ)(σ̀σ)(σ́σ)		* *** *****!*	
c. (σ̀σ)(σ̀σ)(σ́σ)σ	*!	** *****	*

(39) Producing the iambic AntiGarawa-type pattern

σσσσσσ	RIGHTMOST	ALLFEETL	*LAPSE
☞ a. (σ̀σ)(σ̀σ)σ(σ́σ)		** *****	*
b. σ(σ̀σ)(σ̀σ)(σ́σ)		* *** *****!*	*
c. (σ̀σ)(σ̀σ)(σ́σ)σ	*!	** *****	

**Three Problems**

- Undergeneration: Indonesian, Norwegian and Spanish are all counterexamples to the claim that the isolated foot is always the head foot.
- Undergeneration: Indonesian, Norwegian, Spanish, and Garawa are all counterexamples to the claim that the isolated foot always occurs at the right edge.
- Overgeneration: Ignores the observation that iambic bidirectional systems are unattested.

**Conclusions**

- The bidirectional typology is best characterized in terms of an iambic-trochaic asymmetry.
- We can predict the correct typology when INITIAL GRIDMARK and NONFINALITY are the only constraints that can introduce lapse.
- The Lapse Licensing and Asymmetrical Alignment approaches have similar problems.
  - Both undergenerate trochaic bidirectional patterns and overgenerate iambic bidirectional patterns.
- Initial dactyl systems with initial secondary stress (Indonesian, Norwegian, and Spanish) undermine the Constraint Categoricity Hypothesis.

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