The Morphophonology of Rarámuri Affix Order

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Scopal Orders

($X \triangleright Y \equiv X$ has scope over Y)

Des ▷ Caus

tamí	narát-nare
/tamí	narát**-ti-na(le)**/
1SG.ACC	cry**-CAUS-DES**

‘He wants to make me cry’ (23-b)

Caus ▷ Des

baʔwí	bahí-n-ti-ri=ni
/baʔwí	bahí-**na(le)-ti**-ri=ni/
water	drink-**DES-CAUS**-PST.PASS=1SG.NOM

‘They made me want to drink water’ (22-b)

Non-Scopal Order

Caus ▷ Des

nihé	mi	sú-r-ti-na-ma
/nehé	mi	sú**-r-ti-na(le)**-ma/
1SG.NOM	2sg.acc	sew**-CAUS-CAUS-DES**-FUT.SG

‘I will make you want to sew’ (33-a)

Basic Ideas

Basic Ideas: Goal

- **Caballero:** Non-scopal order of Evidential + Desiderative is due to prosodic subcategorization
- **Extended Claim:** All Non-scopal affix orders in Rarámuri are due to prosodic subcategorization (and phonology)

Advantages of a Morphophonological Approach

- The prosodic approach predicts correlations between independent **phonological factors** (e.g. accent position) and affix ordering
- The prosodic approach predicts correlations between affix ordering and independent **idiosyncratic properties of affixes** (e.g., multiple exponence and underlying accent)
- The prosodic approach integrates affix ordering with an **explanatory account of length-alternating affixes**

Basic Ideas: Implementation

- Initial **morphological optimization** derives:
  - only scopal orders
  - Restrictions on possible scopes (e.g., *Causative ▷ Evidential)
  - Linearization bigrams of different strength
- Subsequent **phonological optimization** derives:
  - reordering
  - triggered by prosodic subcategorization requirements of affixes
  - subcategorization requirements may have different strength

The Baseline: Caballero (2010) on Evidential + Desiderative

- Evidential always has scope over the Desiderative (Evidential $\triangleright$ Desiderative)
- In the default case the Evidential suffix is linearized outside/after the Desiderative suffix
- Evidential moves inside of Desiderative to satisfy its prosodic subcategorization (lexical selection frame):
- σ́σ___ (following a stressed + an unstressed syllable)

Evidential ▷ Desiderative

Desiderative ≺ Evidential:

nakó-n(a)-can-a
/nakó-na(le)-ca(ne)-a/
fist.fight-DES-EV
'It sounds like they want to fist fight' (28-a)

Evidential ≺ Desiderative:

atís(i)-ca-nare
/atísi-ca(ne)-na(le)/
sneeze-EV-DES
'It sounds like they want to sneeze' (29-a)

Derivation in the Stratal OT-Approach adopted here

Morphological Optimization:

atísi-nale-cane
Verb-Des-Ev/σ́σ__

Phonological Optimization:

atísi-**cane**-nale
Verb-Ev/σ́σ__-Des

Roadmap

- Background on Rarámuri + theoretical assumptions
- The Interaction with Allomorphy and Multiple Exponence: Causative (+Applicative)
- The Interaction with Length-alternating Affixes: Associated Motion (+Causative)
- The Interaction with Stress: Desiderative (+Associated Motion)
- The Role of Weak and Strong Linearization: Desiderative + Applicative

Background

Rarámuri

General Background on (Choguita) Rarámuri

- Polysynthetic Uto-Aztecan language
  spoken in the Chihuahua state of Mexico
- Documented in detail by Caballero (2008, 2010, 2011)
  (Example numbers refer to Caballero 2010 unless otherwise noted)
- Stratal morphophonology with a wealth of alternations
  including stress tone, vowels and consonants
- Complex variable unstressed vowel reduction (change or deletion)
- Length-alternating suffixes -si(mi), -na(le), ca(ne)

Reordering Affixes

- Applicative -ki ‘to X for’ (Benefactive or Malefactive)
- Causative -ti, -ri, -r, -r-ti ‘make X’
- Desiderative -na(le) ‘want to X’
- (Associated) Motion -si(mi) ‘to go along X-ing’
- Evidential -ca(ne) ‘to sound like X-ing’

(All other affixes follow a fixed template)

The Rarámuri Verb Template (Caballero 2010:168)

(4) Categories expressed in the Choguita Rarámuri verb and verbal domains

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
	INCH	TR	APPL	CAUS	APPL	DESID	MOT	EV	Voice/ Aspect	TAM	TAM	SUB
Inner Stem	Derived Stem		Syntactic Stem			Aspectual Stem			Finite Verb			Sub Verb

Rarámuri Affix Order (Caballero 2010:190)

2nd → / 1st ↓	CAUS	APPL	DESID	MOT	EV
CAUS		✓ non-comp.	✓ comp., non-comp.	✓ comp., non-comp.	✓ fixed scope
APPL	✓ comp.		✓ fixed scope	✓ fixed scope	✓ fixed scope
DESID	✓ comp.	× fixed scope		✓ comp., non-comp.	✓ fixed scope
MOT	✓ comp., non-comp.	× fixed scope	✓ comp., non-comp.		✓ fixed scope
EV	× fixed scope	× fixed scope	✓ non-comp. phon-subcat	× fixed scope	

Theoretical Background

- Stratal Optimality Theory
- Subcategorization as Virtual Phonological Structure
- Gradient Symbolic Representations

Stratal Optimality Theory

Stratal Optimality Theory (Kiparsky 2003, Bermúdez-Otero 2018)

- Different OT-grammars for every stratum
  (Root, Stem, Word, Phrase)
- Optimization happens cyclically inwards-out
  (Root, Stem, . . .)
- Variation by variable ranking:
  Variably ranked constraints may be ranked either way,
  but the ranking is fixed for any specific OT-evaluation

Rarámuri Affix Order (Caballero 2010:168)

(4) Categories expressed in the Choguita Rarámuri verb and verbal domains

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
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Inner Stem	Derived Stem		Syntactic Stem			Aspectual Stem			Finite Verb			Sub Verb

Rarámuri Strata in Caballero (2010) (p.169)

(6) Morphologically conditioned phonology

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
Inner Stem	**Derived Stem**		**Syntactic Stem**			**Aspectual Stem**			**Finite Verb**			**Subordinate Verb**
Haplology												
CL												
Imperative stress-shift												
Passive-triggered lengthening												
Round Harmony												

Strata assumed here

- **Root Level** ≈ Caballero's Derived Stem
- **Stem Level** ≡ Caballero's Aspectual Stem
  - Affix Reordering
  - lengthening of stressed -nále
- **Word Level** ≡ the morphosyntactic verb
  - Final lengthening of -na(le),-si(mi), -ca(ne)
  - Partial lengthening of -na(le) + ca(ne) before -i,-a,-o

Prosodic Subcategorization as Virtual Structure

Prosodic Subcategorization

Lexical specification for individual affixes

for the specific phonological contexts

where they can appear

Applications of Prosodic Subcategorization

- Infixation (Yu 2002)
- Ineffability (Clinton-ize vs. *Bush-ize, Raffelsiefen 2004)
- Stress Shifting (e.g. weak retraction, Bermúdez-Otero 2018)
- Epenthesis (McCarthy and Prince 1993)

Weak Retraction in English (Bermúdez-Otero 2018:25)

a. *heavy antepenult*

amḗnable

coméstible

deléctable

inelúctable

b. *light antepenult*

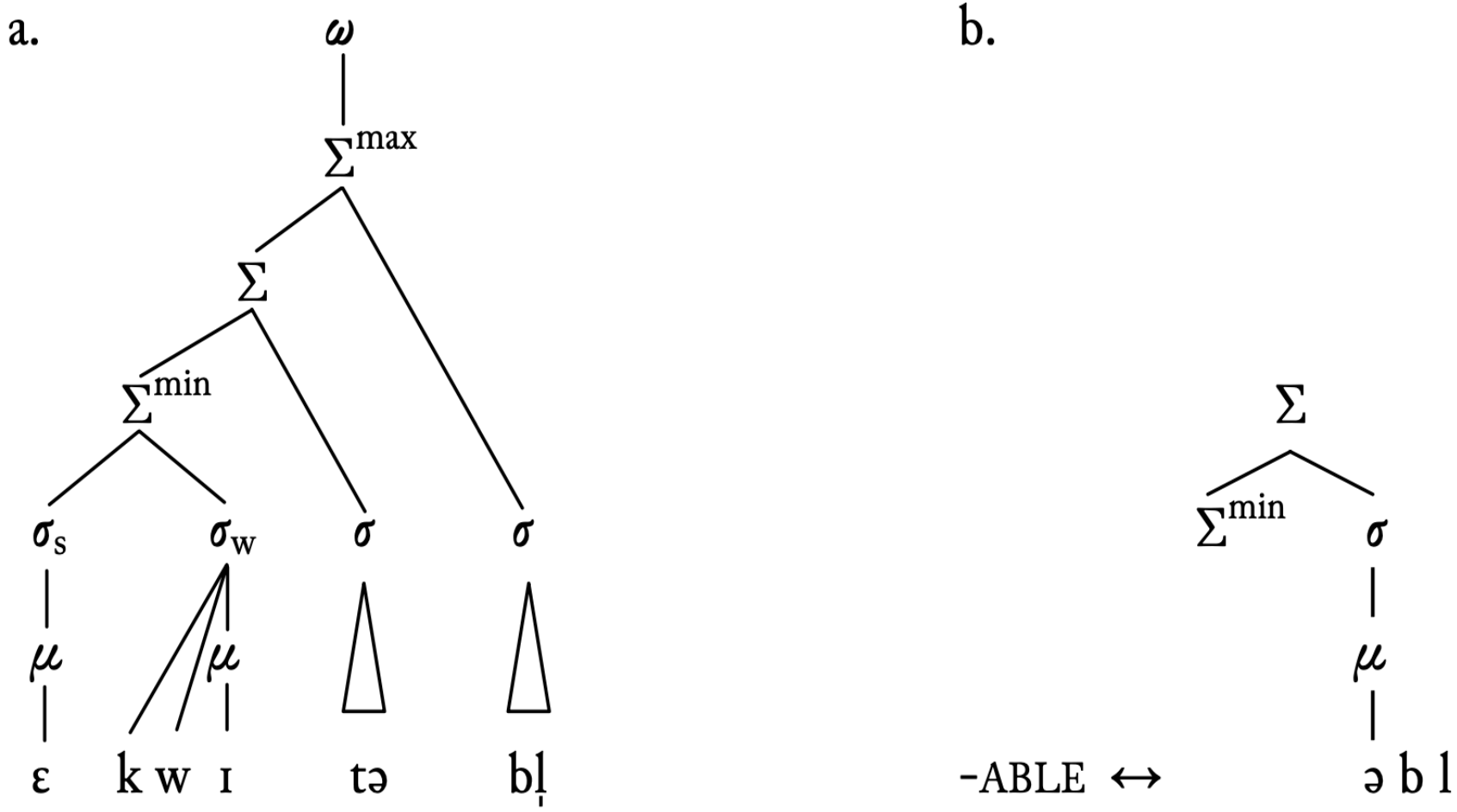
indómĭtable

indúbĭtable

inéxŏrable

irréfrăgable

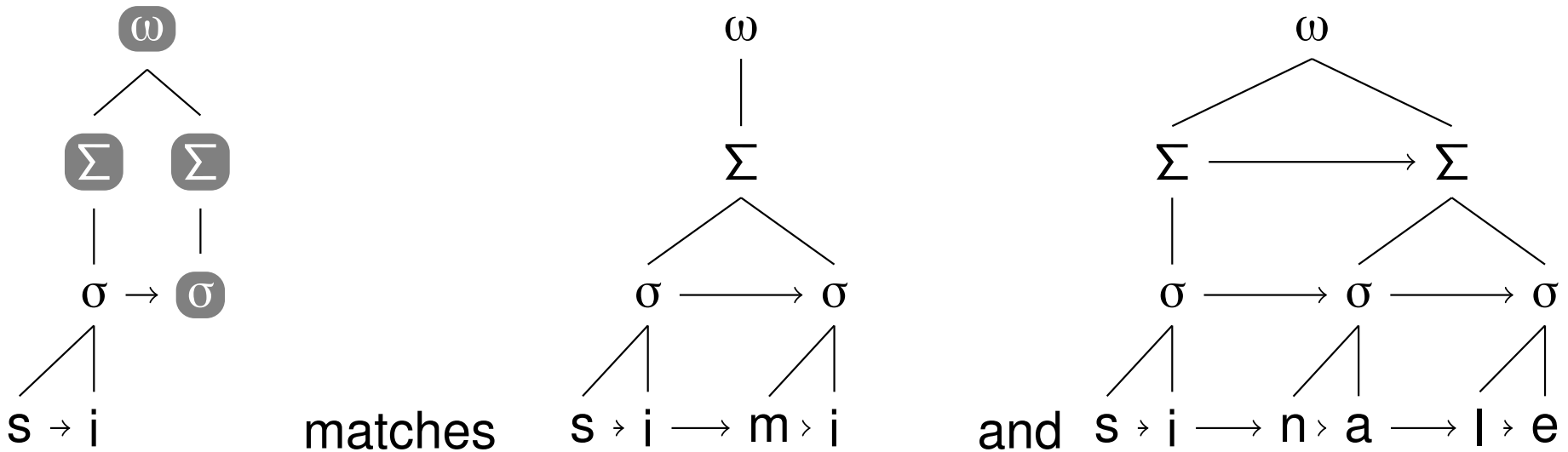
Weak Retraction by Subcategorization (Bermúdez-Otero 2018:25)



Subcategorization as Virtual Structure (Lionnet and Rolle 2020)

- Subcategorization ≡ **virtual** phonological structure
- For every substantive tier, there is a corresponding virtual tier
- Substantive phonology is pronounced.
  Virtual phonology remains unpronounced,
  but is matched to substantive phonology
- Virtual and substantive units are integrated
  (via dominance and precedence relations)

Subcategorization as Virtual Structure (Lionnet and Rolle 2020)



(shorthand: si σ)

Matching

A **substantial path** through a graph *G* is a path in *G*
which contains only substantial nodes

A **selectional path** through a graph *G* is a path in *G*
which contains only selectional nodes

A **selectional subgraph** of a graph *G* is a subgraph of *G*
which contains only selectional nodes

A selectional subgraph *S* of a Graph *G* matches *G* iff
for every selectional path *P* from a substantial node *N* of *G* to a node *N′* of *S*
there is a substantial path *P′* from *N* to a substantial node *N″*
such that Label(*P*[i]) = Label(*P′*[i])

(selectional ≡ virtual)

Subcategorization and OT

Different versions of the constraint

TEMPLATESATISFACTION

evaluate whether a virtual/selectional structure

is matched in a given output

Subcategorization Discharge

If a selectional subgraph S of G matches G

at the output of a stratum,

S is removed from G

Virtual Structure and Strata

Virtual structure implies

that subcategorization can be inherited

across strata (if not discharged)

Gradient Symbolic Representations

Gradient Symbolic Representations (Smolensky and Goldrick 2016)

- All linguistic units may have different activation levels $0 \leq A \leq 1$
- Only fully activated units ($A = 1$) are pronounced
- (also: Rosen 2016, Zimmermann 2018, 2019, 2021, Hsu 2022)

Specific Assumptions here:

- Combination with Optimality Theory (not Harmonic Grammar)
- Constraints may be gradient **or** categorial
- Distinction between weak (white), middle (gray), strong (black)

Three Domains of Gradience (Strength)

- **Linear order:** relative order of morpheme pairs is weak or strong
- **Subcategorization:** ≡ (virtual) structure
  can be weak, middle strength or strong
- **Segments**: Segments with activation < 1
  are not syllabified, not pronounced
  and cannot satisfy subcategorization requirements

  (but may be strengthened in phonological optimization)

Notation for Different Strengths

Strong 1st σ, weak 2nd σ, weak subcategorization: -na∗le(σ)

Strong 1st σ, weak 2nd σ, medium subcategorization: -simiσ

Strong subcategorization and segment -ǿr$_{Caus}$

The Interaction of Affix Order with Allomorphy and Multiple Exponence: Causative (+ Applicative)

The Causative: Allomorphy and Multiple Exponence

- 4 surface variants: -ti, -ri, -r and -r-ti
- Choice of -ti vs. -ri dependent on specific lexical roots
- -r and -r-ti only immediately after stressed syllables

Causative Allomorphy: **Analysis**

- Two listed allomorphs -r and -ti
- may be combined: -r-ti
- Specific roots impose rhothicity on a following affix
  (by a floating [+rhotic] feature or a weak [r])
- -ti → -ri, -r → -r
- Corollary: -ri only appears after roots (not after other affixes)

Caus ▷ Appl

- **Empirical Generalizations:**
  - Scope is fixed
  - Both orders occur
- **Caballero:** Order is in free variation
- **Reinterpretation:**
  - 'Wrong orders' involve Causative -r or -r-ti
  - Causative -r subcategorizes for end of stressed syllable (-ór)
  - Causative -ti is attracted to -r via COHERENCE
  - **Prediction:** Order correlates with allomorphy/multiple exponence

Caus ▷ Appl

Scopal Order

jéni	dúlse	íw-ki-ti-ri	jadíra
/jéni	dúlse	íw-**ki**-**ti**-ri	jadíra/
Yeni	candy	bring.APPL-**APPL**-**CAUS**-IMP.SG	Yadira

'Make Jeni bring candy for Yadira' (31-c)

Non-scopal Order

mi=n	tamí	kocí	ubá-r-ti-ki-ma
/mi=n	tamí	kocí	ubá-**r**-**ti**-**ki**-ma/
2SG.ACC=1SG.NOM	1SG.ACC	dog	bathe-**CAUS**-**CAUS**-**APPL**-FUT.SG

'I'll make you bathe the dog for me' (32-c)

Underlying Linearization: Causative

	Caus ▷ Appl	Des ▷ Appl	Caus ◁▷ Des	Caus ◁▷ Mot
Scope	fixed	fixed	free	free
Linear. Strength	weak	strong	strong	weak
Reversal triggered by	Caus	—	Caus	Caus, Mot

Constraints (I)

TEMP(LATE) SAT(ISFACTION)$_{\text{Strong}}$	Assign $*$ to every subcategorization frame of activation 1 which is not matched in the output
TEMP(LATE) SAT(ISFACTION)	Assign X violations to every subcategorization frame of activation X which is not matched in the output

Constraints (II)

COH(ERENCE)	Assign $*$ to every coreferential pair of affixes which are not adjacent in the output
LIN(EARITY)$_{\text{Strong}}$	Assign $*$ to every pair of affixes A_1, A_2 such that $A_1 \prec_{\text{Strong}} A_2$ in the input and $A_2 \prec A_1$ in the output
LIN(EARITY)	Assign X to every pair of affixes A_1, A_2 such that $A_1 \prec_X A_2$ in the input and $A_2 \prec A_1$ in the output

Overall Ranking

$$\textsc{TempSat}_{\text{Strong}} \equiv \textsc{Coherence}$$

$$\gg$$

$$\textsc{Linearity}_{\text{Strong}}$$

$$\gg$$

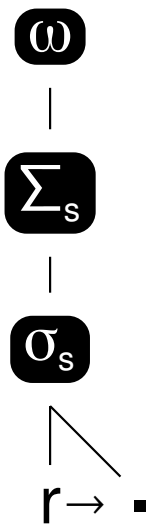
$$\textsc{Dep}\,\lightning \sim \textsc{Dep}\,*$$

$$\gg$$

$$\textsc{Linearity} \sim \textsc{TempSat}$$

Subcategorization of Causative -r

-r should be final in
the main-stressed syllable
of the PWord containing -r



(“ .” ≡ right edge)

Caus ▷ Appl (fixed scope)

Scopal Order

Input: = a.	TEMPSAT$_{St}$	COH	LIN
☞ a. íwi-ki$_{Appl}$-ti$_{Caus}$			
b. íwi-ti$_{Caus}$-ki$_{Appl}$			*!

Non-scopal Order

Strong Subcategorization: -ór$_{Caus}$

Input: = a.	TEMPSAT$_{St}$	COH	LIN
a. ubá-ki$_{Appl}$-ór$_{Caus}$-ti$_{Caus}$	*!		
b. ubá-r-ki$_{Appl Caus}$-ti$_{Caus}$		*!	
☞ c. ubá-r$_{Caus}$-ti$_{Caus}$-ki$_{Appl}$			*

-ór$_{Caus}$ moves inside to satisfy its subcategorization and drags -ti along

Exceptional Causative Reordering without -r

tamí	ko=mi	oʔpés-ti-ki-ma	aré	ba
/tamí	ko=mi	oʔpési-**ti**-**ki**-ma	alé	ba/
1SG.ACC	EMPH=2SG.NOM	vomit-**CAUS**-**APPL**-FUT.SG	DUB	CL

‘You’ll make him throw up on me’ (32-a)

Exceptional Causative Reordering without -r

- Hidden presence of -r
- -r attaches to bisyllabic root with intial stress (pési) ← -r
- -r's subcategorization causes deletion of unstressed vowel (pésr)$_\sigma$
- (Infixation is independently excluded: *pé-rsi)
- The [sr]-cluster is tolerated at the Stem Level
  but repaired by deletion at the Word Level:
  o'(pésr)$_\sigma$-ti-ki-ma → o'(pés)$_\sigma$-ti-ki-ma
- **Prediction:** Causative Reordering without -r is only possible
  if roots have nonfinal stress

Length-alternating Affixes: Causative + Associated Motion

Length-alternating Affixes

- Several suffixes involved in reordering appear either:
  - Bisyllabic
    in prominent (stressed or final) position
  - Monosyllabic
    in non-prominent (unstressed and non-peripheral) position

- **Analysis** – two lexical properties:
  - a single lexical syllable + subcategorization for a second syllable
  - 'strong' (fully activated) segments in the first syllable
    'weak' (partially activated) segments potentially filling a second σ

- **Warning:** Long and short variants may be additionally shortened by syncope: -simi → -sim, -si → -s

Length-alternating Affixes and Non-scopal Affix Order

Final length-alternating Affixes

may trigger rightward movement of an inner affix

to satisfy their subcategorization reqirement

for a following syllable

Length-alternating Affixes: Evidential -ca(ne)

Long in final position:

páki**-cani**
/páki**-ca(ne)**/ ‘It sounds like brewing’
brew**-EV**

Short before another syllable:

atís**-ca**-nar-a
/atís**-ca(ne)**-na(le)-a/ ‘It sounds like they want to sneeze’
sneezeEV**-EV**-DES-PROG

(2008:289)

Length-alternating Affixes: Motion -si(mi)

Long in final position:

nári**-simi**
/nale**-si(mi)**/
ask**-MOT**

Short before another syllable:

ticí-k**-si**-ma
/ticí-ki**-si(mi)**-ma/
bark-CAUS**-MOT**-PST

(2008:297+)

Caus ▷ Mot

Scopal Order

mi=n	tán-si-ti-ma	rá
/mi=ni	táni-**si(mi)**-**ti**-ma	olá/
2SG.ACC=1SG.NOM	ask-**MOT**-**CAUS**-FUT.SG	CER

'I'll make you go along asking for things' (21-b)

Non-scopal Order

mi=n	piwá-r-si-mo	rá
/mi=ni	piwá-**r**-**si(mi)**-ma	olá/
2SG.ACC=1SG.NOM	smoke-**CAUS**-**MOT**-FUT.SG	CER

'I'll make you go along smoking' (34-b)

Mot ▷ Caus

Scopal Order

we	tamí	korú-ti-simi
/we	tamí	korú-**ti**-**simi**/
INT	1SG.ACC	feel.like.eating-**CAUS**-**MOT**

‘They are going along making me want to eat’ (20-d)

Non-scopal Order

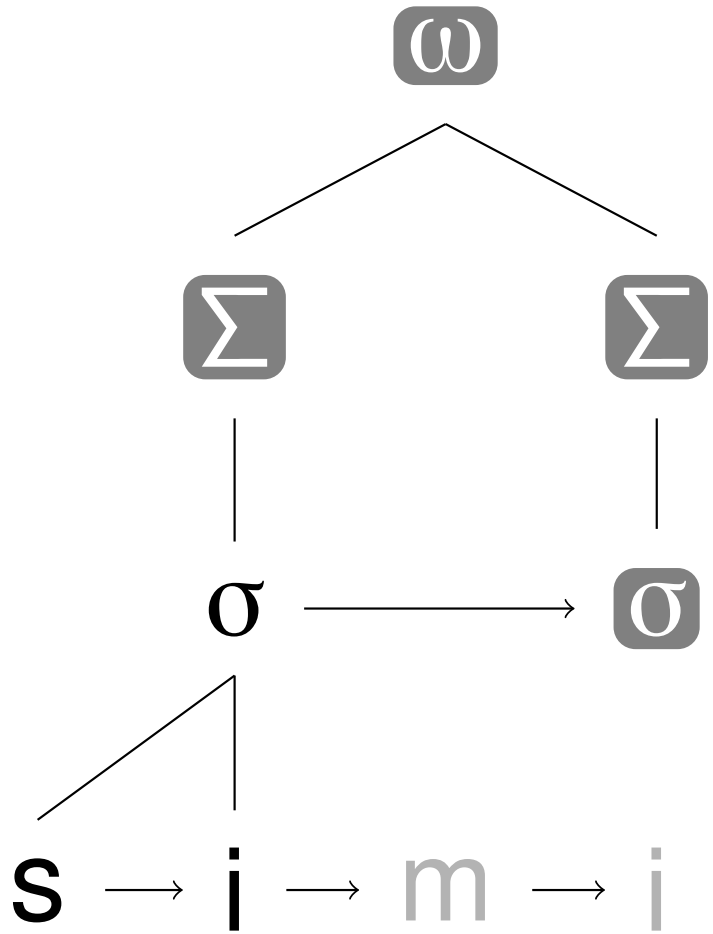
nihé	mi	sú-s-ti-ma	sipúci
/nehé	mi	sú-**si**-**ti**-ma	sipúca/
1SG.NOM	2SG.ACC	sew-**MOT**-**CAUS**-FUT.SG	skirt

‘I will go along making you sew the skirt’ (34-d)

Caus ◁,▷ Mot

- **Empirical Generalizations:**
  - both scopal readings possible
  - both linear orders for both readings
- **Analysis:**
  - weak linearization
  - → Mot may trigger reordering of Caus -ti
  - Orders depending on multiple exponence:
  - -r blocks/triggers reordering

Underlying Structure of Associated Motion -si(mi)



Different Subcategorizations

Strong: -ór$_{\text{Caus}}$

Medium: -simiσ$_{\text{Mot}}$

None: -ti$_{\text{Caus}}$

Constraint on Adding Activation

DEP ↯ Assign $*$ to every morpheme *M*
such that for some phonological unit in *M*
its output activation is greater than its input activation0

(Blocks satisfaction of -si(mi)'s subcategorization

by realizing its weak segments)

Caus ▷ Mot (Stem Level)

Input: sú-simiσ_{Mot}-ór$_{Caus}$

(34-b,c)	TempSat$_{St}$	Dep ↯	Lin	TempSat
a. sú-simiσ_{Mot}-ór$_{Caus}$	*!			*
b. sú-r$_{Caus}$-simi$_{Mot}$		*!	*	
☞ a. sú-r$_{Caus}$-simiσ_{Mot}			*	*

Moving in -ór

(also: (34-a) under assumption of a hidden -r$_{caus}$)

Input: sú-simiσ_{Mot}ti$_{Caus}$

(21-a,b,c)	TempSat$_{St}$	Dep ↯	Lin	TempSat
☞ a. sú-simi$_{Mot}$-ti$_{Caus}$				
b. sú-simi$_{Mot}$-ti$_{Caus}$		*!		
c. sú-ti$_{Caus}$-simi$_{Mot}$		*!	*	
d. sú-ti$_{Caus}$-simiσ_{Mot}			*!	*

No reordering with -ti

Mot ▷ Caus (Stem Level)

No reordering possible with -ór:

(20-b,c)	TEMPSAT$_{St}$	DEP ↯	LIN	TEMPSAT
☞ a. sú-r$_{Caus}$-simiσ$_{Mot}$				*
b. sú-r$_{Caus}$-simi$_{Mot}$		*!		
c. sú-si$_{Mot}$-ór$_{Caus}$	*!		*	

Mot ▷ Caus (Stem Level)

Free variation with -ti:

(20-a,d)	TEMPSAT$_{St}$	DEP ↯	LIN	TEMPSAT
☞ a. sú-ti$_{Caus}$-simiσ$_{Mot}$				*
b. sú-ti$_{Caus}$-simi$_{Mot}$		*!		
c. sú-si$_{Mot}$-ti$_{Caus}$			*!	

(34-d)	TEMPSAT$_{St}$	DEP ↯	TEMPSAT	LIN
a. sú-ti$_{Caus}$-simiσ$_{Mot}$			*!	
b. sú-ti$_{Caus}$-simi$_{Mot}$		*!		
☞ c. sú-si$_{Mot}$-ti$_{Caus}$				*

Word Level Extension of -si(mi)

(20-b,c)	TEMPSAT	DEP ↯
a. súr$_{Caus}$-simiσ$_{Mot}$	*	
☞ b. sú-r$_{Caus}$-simi$_{Mot}$		*

The Importance of Strata for length-alternating Affixes

- The option of realizing weak segments does not interfere with the triggering of affix movement by ⓞ-subcategorization
- Affix movement happens also in the presence of following Word-Level affixes:

nihé	mi	sú-s-ti-ma	sipúci
/nehé	mi	sú-**si**-**ti**-ma	sipúca/
1SG.NOM	2SG.ACC	sew-**MOT**-**CAUS**-FUT.SG	skirt

'I will go along making you sew the skirt' (**non-scopal order**) (34-d)

Correct Predictions of the Analysis

- In forms with Causative -r this will always be internal, independently of scope
- In forms with Causative -ti and Caus $\triangleright$ Mot only scopal ordering is possible

Stress:
Desiderative + Associated Motion

Special Features of Desiderative -na(le)

- The only length-alternating suffix which may carry accent
- $\approx$ the only length-alternating suffix with an underlying accent
- Only the long variant may carry accent
- The only length-alternating suffix which may occur non-finally in its long variant

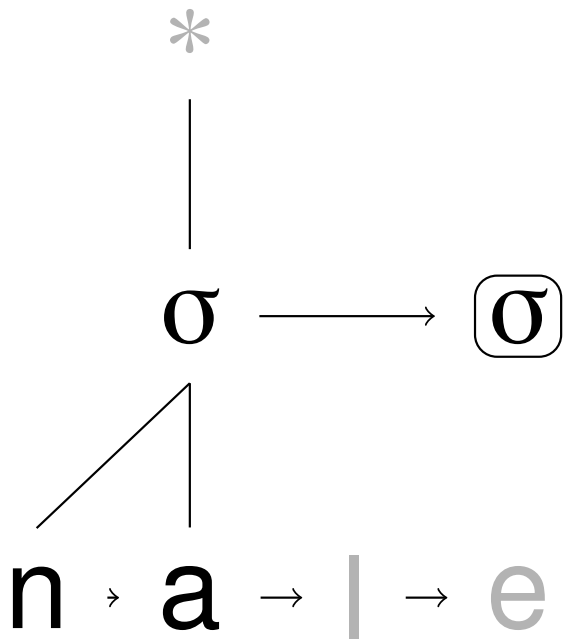
Rarámuri Stress

- Lexical Accent System:
  Realize underlying accent if possible,
  otherwise default accent
- Three-syllable window at left word-edge
- (local accent shift and other complications irrelevant here)

Des ◁,▷ Mot

- **Empirical Generalizations:**
  - both scopal readings possible
  - both linear orders for both readings
- **Analysis:**
  - Mot's subcategorization may trigger reordering of Des
  - Des may move inside of Mot to provide fenestral stress
  - ⇒ Ordering partially contingent on stress

Underlying Structure of Desiderative -na(le)



Relevant Constraints on Stress

$1*$	Every prosodic word should have exactly one overt accent
$3\sigma\boxdot$	Underlying accent must originate in a morpheme in the 3 initial syllables
DEP $*$	Assign $*$ to every epenthetic accent
2nd	Accent should be on the second syllable of a PWord

Des ▷ Mot – Non-Scopal Order

kurí	u?pá	naparí=n	ku	simí-ka koci**-nál-si**-a=n	iná-ri
kurí	u?pá	naparí=n	ku	simí-ka koci**-nál(e)-si(mi)**-a=ni	iná-li
just	last	REL=1SG.NOM	REV	sleep**-DES-MOT**-PROG-1SG.NOM	go-PST

'Last time I went there, I wanted to go along sleeping' (35-c)

(translation reconstructed/corrected from description + Spanish translation)

Des -ná(le) moves inside to provide non-epenthetic accent

Des ▷ Mot – Non-Scopal Order

Input = koci-simiσ_{Mot}-na∗leσ_{Des}

	1∗	3σ▣	DEP ∗	DEP ↯	TEMPSAT	LIN	2nd
a. ko ci si σ na σ	*!				σ σ		
b. ko ci si na le		*!					*
c. ko ci si na le			*!				
d. ko ci na le si mi				**!		*	*
☞ e. ko ci na le si σ				*	σ	*	*

Mot ▷ Des – Non-scopal Order

ne	we	koʔá-**s**-**niri**
/ne	we	koʔá-si(mi)-na(le)/
1SG.NOM	INT	eat-**MOT**-**DES**-PROG

‘I’m going along wanting to eat’ (35-a)

-na(le) moves out to satisfy -si(mi)’s σ-subcategorization

Mot ▷ Des – Non-scopal Order

Stem Level:

Input = koʔa-na∗le$_{\sigma\,\text{Des}}$-simi$_{\sigma\,\text{Mot}}$

	DEP ↯	DEP ∗	TEMPSAT	LIN
a. koʔa-nále-$_{\text{Des}}$-simi$_{\text{Mot}}$	*!*			
b. koʔá-nale$_{\text{Des}}$-simi$_{\text{Mot}}$	*!	*		*
c. koʔá-nale$_{\text{Des}}$ -simi$_{\sigma\,\text{Mot}}$		*	*!	*
☞ d. koʔá-simi$_{\text{Mot}}$-nale$_{\sigma\,\text{Des}}$		*	*	*

Word Level:

koʔá-simi$_{\text{Mot}}$-nale$_{\sigma\,\text{Des}}$ → koʔá-simi$_{\text{Mot}}$-nale$_{\text{Des}}$

Mot ▷ Des – Scopal Order (2 short Allomorphs)

ne	isíi**-n-si**-a	iná-ro
/ne	isíi-na(le)-si(mi)-a	iná-ro/
1SG.NOM	urinate**-DES-MOT**-PROG	go-MOV

‘I’m going along wanting to urinate’ (19-c)

Mot ▷ Des – Scopal Order (2 short Allomorphs)

Stem Level: **Movement blocked by LIN ≫ TEMPSAT**

Full Input Representation: isí-na∗le(σ)-simi(σ)

Input: = a.	1∗	3σ▣	DEP ϟ	DEP ∗	LIN	TEMPSAT	2nd
☞ a. i si na si(σ)						*	
b. i si si na(σ)					*!	(*)	
c. i si na si mi			*!				

Des ▷ Mot – Scopal Order

Stem Level: **Movement blocked by DEP ↯≫ DEP ∗**

Input = to-simi$_{\sigma\,\text{Mot}}$-na∗le$_{\sigma\,\text{Des}}$

Input: = a.	1∗	3σ▣	DEP ↯	DEP ∗	TEMPSAT	LIN	2nd
a. to si na σ	*!				σ		
☞ b. to si na σ				*	σ		*
c. to na si σ				*	σ!	*	*
d. to si na le		*!	*	*			
e. to na le si σ			*!		σ		

Des ▷ Mot – Scopal Order

Word Level:

Input: = a.	DEP ∗	LIN	TEMPSAT	DEP ↯
a. to sinale(σ)			*!	
☞ b. to si na le				*

Correct Predictions

- Des -na(le) may only move inside of Mot -si(mi) with unstressed roots

Desiderative + Applicative
The Role of weak and strong Linearization

Rarámuri Affix Order (Caballero 2010:190)

$2^{nd} \rightarrow$ $1^{st} \downarrow$	CAUS	APPL	DESID	MOT	EV
CAUS		✓ non-comp.	✓ comp., non-comp.	✓ comp., non-comp.	✓ fixed scope
APPL	✓ comp.		✓ fixed scope	✓ fixed scope	✓ fixed scope
DESID	✓ comp.	× fixed scope		✓ comp., non-comp.	✓ fixed scope
MOT	✓ comp., non-comp.	× fixed scope	✓ comp., non-comp.		✓ fixed scope
EV	× fixed scope	× fixed scope	✓ non-comp. phon-subcat	× fixed scope	

Des ▷ Appl

Scopal Order:

(Examples in Caballero 2010

only with the (Root-Level) Applicatives -si/-wi/-ni)

Des ▷ Appl

- **Empirical Generalization:**
  - Scope is fixed
  - only scope-conforming order occurs
- **Analysis:**
  - Des subcategorizes for a following syllable, **but**
  - Subcategorization is weak, linear order is strong
  - → no reordering

Des ▷ Appl

Reading: Desiderative $\triangleright_{Str}$ Applicative

Strong linearization

Weak Subcategorization: -naσ_{Des}

Input: = a.	TEMPSAT$_{Str}$	LIN$_{Str}$	DEP $*$	TEMPSAT	LIN
☞ a. ticí-ki$_{Appl}$-naσ_{Des}				*	
a. ticí-na$_{Des}$-ki$_{Appl}$		*!			*

More on Length-alternating Suffixes

Three Reasons for Choosing the Long Alternant

- Final position (-na(le), -ca(ne), -si(mi))
- Being stressed (only -ná(le))
- Preceding PROG -a, IMPF -i or EPIST -o (only -na(le) and -ca(ne))

Long -nale and -cane before -a/-i-o

narán-t-can-a-ci
/narán-ti-**cane**-**a**-ci/
cry-CAUS-EV-PROG-TEMP
‘When it sounds like they are making her cry. . . ’ (2008:299)

kací-si-nir-i
/kací-si-**nale**-**i**/
spit-MOD-IMPF
‘He was feeling like going along spitting. . . ’ (2008:300)

Long -nale and -cane before -a/-i-o

koʔá-r-ti-nir-o
/koʔá-r-ti-**nale**-**o**/
eat-CAUS-CAUS-DES-EP
‘When it sounds like they are making her cry. . . ’ (2008:300)

but:

porá-p-ti-si-o
/porá-p-ti-**si**-**o**/
cover-REV-REFL-MOT-EP
‘I went along wanting to sleep’ (2008:301)

*porá-p-ti-**sim**-o

Lengthening before -a/-i/-o – Analysis

- -a/-i/-o subcategorize for a preceding coronal consonant
- e.g. -$\overset{\frown}{\text{C}_{\text{cor}}}$a
- At the Word Level, this triggers realization of the medial coronal consonants in -na(le) and -ca(ne) by adding activatiun
- No effect for -si(mi) since weak [m] is labial

Extension of Length-alternating Suffixes before -a/-i/-o

(Word Level)

Extending -nale

Input = koʔá-r-ti-na∗le$_{\sigma\,\text{Des}}$-(C$_{\text{cor}}$)a

Input: = a.	DEP C	LIN	TEMPSAT	DEP ϟ
a. koʔá-r-ti-na∗le$_{\text{Des}}$-(C$_{\text{cor}}$)a			(*)!	
b. koʔá-r-ti-na∗le$_{\text{Des}}$**t**a	*!			
☞ c. koʔá-r-ti-na**l**e∗$_{\text{Des}}$-a				*

Not Extending -simi

Input = porá-p-ti-simi$_{\sigma\,\text{Mot}}$-(C$_{\text{cor}}$)o

Input: = a.	DEP C	LIN	TEMPSAT	DEP ϟ
☞ a. porá-p-ti-simi$_{\text{Mot}}$-(C$_{\text{cor}}$)o			(*)	
b. porá-p-ti-simi$_{\text{Mot}}$**t**-o	*!			
c. porá-p-ti-si**m**i$_{\text{Mot}}$-(C$_{\text{cor}}$)o			(*)	*!

Added Value of the Approach here

The combination of

subcategorization as virtual structure

+

Gradient Symbolioc Representations

captures the disjunctive conditions on length alternating suffixes

as unitary processes

Summary

- All non-scopal orders of Rarámuri suffixes can be captured by phonological optimization or prosodic subcategorization
- This makes better – finer grained – predictions on the occurring combinations of ordering patterns and other affix properties
- Added value: Unified account of length-alternating suffixes
- Crucial role of gradient symbolic representations, strata and subcategorization via virtual phonological structure

Overall Ranking

$$\textsc{TempSat}_{\text{Strong}} \equiv \textsc{Coherence}$$

$$\gg$$

$$\textsc{Linearity}_{\text{Strong}}$$

$$\gg$$

$$\textsc{Dep}\,\lightning \sim \textsc{Dep}\,*$$

$$\gg$$

$$\textsc{Linearity} \sim \textsc{TempSat}$$

Constraints (I)

TEMP(LATE) SAT(ISFACTION)$_{\text{Strong}}$	Assign $*$ to every subcategorization frame of activation 1 which is not matched in the output
TEMP(LATE) SAT(ISFACTION)	Assign X violations to every subcategorization frame of activation X which is not matched in the output

Constraints (II)

COH(ERENCE)	Assign $*$ to every coreferential pair of affixes which are not adjacent in the output
LIN(EARITY)$_{\text{Strong}}$	Assign $*$ to every pair of affixes A_1, A_2 such that $A_1 \prec_{\text{Strong}} A_2$ in the input and $A_2 \prec A_1$ in the output
LIN(EARITY)	Assign X to every pair of affixes A_1, A_2 such that $A_1 \prec_X A_2$ in the input and $A_2 \prec A_1$ in the output

Constraints (III)

DEP $*$ Assign $*$ to every epenthetic accent

DEP $\lightning$ Assign $*$ to every morpheme *M*
such that for some phonological unit in *M*
its output activation is greater than its input activation0

Causative + Desiderative

Rarámuri Affix Order (Caballero 2010:190)

2nd → / 1st ↓	CAUS	APPL	DESID	MOT	EV
CAUS		✓ non-comp.	✓ comp., non-comp.	✓ comp., non-comp.	✓ fixed scope
APPL	✓ comp.		✓ fixed scope	✓ fixed scope	✓ fixed scope
DESID	✓ comp.	× fixed scope		✓ comp., non-comp.	✓ fixed scope
MOT	✓ comp., non-comp.	× fixed scope	✓ comp., non-comp.		✓ fixed scope
EV	× fixed scope	× fixed scope	✓ non-comp. phon-subcat	× fixed scope	

Caus $\triangleleft$, $\triangleright$ Des

- **Empirical Generalization:**
  - both scopal readings possible
  - Caus $\triangleright$ Des: both linear orders
  - Des $\triangleright$ Caus: only scopal order
- **Analysis:**
  - Caus has strong subcategorization (may trigger reordering)
  - Des has weak subcategorization (cannot trigger reordering)
  - { Caus, Des } has strong linearization Stress (DEP $*$) cannot trigger reordering

Scopal Orders

Des ▷ Caus

tamí	narát-nare
/tamí	narát**-ti-na(le)**/
1SG.ACC	cry**-CAUS-DES**

‘He wants to make me cry’ (23-b)

Caus ▷ Des

baʔwí	bahí-n-ti-ri=ni
/baʔwí	bahí-**na(le)-ti**-ri=ni/
water	drink-**DES-CAUS**-PST.PASS=1SG.NOM

‘They made me want to drink water’ (22-b)

Non-Scopal Order

Caus ▷ Des

nihé	mi	sú-r-ti-na-ma
/nehé	mi	sú**-r-ti-na(le)**-ma/
1SG.NOM	2sg.acc	sew**-CAUS-CAUS-DES**-FUT.SG

‘I will make you want to sew’ (33-a)

koʔá-r-ti-ni-sa
/koʔá**-r-ti-na(le)**-sa/
eat**-CAUS-CAUS-DES**-IMP
‘Let’s make her want to eat’ (33-d)

Underlying Linearization: Causative

	Caus ▷ Appl	Des ▷ Appl	Caus <> Des	Caus <> Mot
Scope	fixed	fixed	free	free
Linear. Strength	weak	strong	strong	weak
Reversal triggered by	Caus	—	Caus	Caus, Mot

Caus ▷ Des (stressed root)

Reading: Causative ▷ Desiderative (strong linearization)

Strong Subcategorization: -r$_{Caus}$ /ó_

Weak Subcategorization: -na$_{Des}$ /_ σ

Non-scopal

Input: = a.	TempSat$_{St}$	Coh	Lin$_{St}$	TempSat	Lin
a. sú-na$_{Des}$-r$_{Caus}$-ti$_{Caus}$	*!				
b. sú-r-na$_{Caus\,Des}$-ti$_{Caus}$		*!	*		*
☞ c. sú-r$_{Caus}$-ti$_{Caus}$-na$_{Des}$			*	*	**

Reading: Causative ▷ Desiderative (strong linearization)

Weak Subcategorization: -na$_{Des}$ /_ σ

Scopal

Input: = a.	TempSat$_{St}$	Coh	Lin$_{St}$	TempSat	Lin
☞ a. bahí-na$_{Des}$-ti$_{Caus}$					
b. bahí-ti$_{Caus}$-na$_{Des}$			*!	*	**

Des ▷ Caus (stressed root)

Reading: Desiderative ▷ Causative (strong linearization)

Weak Subcategorization: -na$_{Des}$ /__ (σ) **Scopal**

Input: = a.	TEMPSAT$_{St}$	COH	LIN$_{St}$	TEMPSAT	LIN
☞ a. narᵘá-ti$_{Caus}$-na(σ)$_{Des}$				*	
b. narᵘá-na$_{Des}$-ti$_{Caus}$			*!		*

Des ▷ Caus (unstressed root)

ma=ni	mi	ubá-r-nare
/ma=ni	mi	uba**-r-na(le)**/
already =1SG.NOM	2SG.ACC	bathe**-CAUS-DES**

'I want to bathe you' (23-c)

-na(le) doesn't move in across -r even with an unstressed root

Underlying Linearization: Causative

	Caus ▷ Appl	Des ▷ Appl	Caus <> Des	Caus <> Mot
Scope	fixed	fixed	free	free
Linear. Strength	weak	strong	strong	weak
Reversal triggered by	Caus	—	Caus	Caus, Mot

Des ▷ Caus – Scopal Order (unstressed root)

Strong Subcategorization: -r_{Caus} /ó__

Strong Linearization **(blocks movement of -na(le)) by TEMPSAT$_{ST}$**

Input: = a.	3σ▣	TEMPSAT$_{ST}$	LIN$_{ST}$	DEP ∗	TEMPSAT	LIN	2nd
a. u ba r na re		*!					*
☞ b. u ba r na re				*		*	
c. u ba na le r		*!	*		*		

Back to the Evidential

Rarámuri Affix Order (Caballero 2010:190)

2nd → 1st ↓	CAUS	APPL	DESID	MOT	EV
CAUS		✓ non-comp.	✓ comp., non-comp.	✓ comp., non-comp.	✓ fixed scope
APPL	✓ comp.		✓ fixed scope	✓ fixed scope	✓ fixed scope
DESID	✓ comp.	× fixed scope		✓ comp., non-comp.	✓ fixed scope
MOT	✓ comp., non-comp.	× fixed scope	✓ comp., non-comp.		✓ fixed scope
EV	× fixed scope	× fixed scope	✓ non-comp. phon-subcat	× fixed scope	

Underlying Linearization: Evidential

	Ev ▷ Appl	Ev ▷ Caus	Ev ▷ Des	Ev ▷ Mot
Scope	fixed	fixed	fixed	fixed
Strength	strong	strong	**weak**	strong
Reversal triggered by	—	—	**Ev**	—

Open Question

Could Evidentials reorder wrt other affixes?

(Applicative, Causative, etc.)

(predicted by the analysis here)

Open Answer

In all data of Caballero (2010)

with Evidential + { Applicative, Causative, . . . }

the prosodic subcategorization of Evidential is already satisfied

in the scopal order

Root Stress

		Evidence	
awi	‘dance’	(unstressed)	unstressed occurrence (2008, p144:(47-a))
bahí	‘drink’	(stressed)	stressed before -sá (2008, p.179:(8-b))
iki	‘happen’	(unstressed)	unstressed occurrence (2008, p.434:(3))
isí	‘urinate’	(stressed)	stressed before -sá (2008, p.179:(8-c))
to	‘take’	(unstressed)	unstressed occurrence (2011, p.752:(1-f))
ko’	‘eat’	(unstressed)	unstressed occurrence (2008, p.340:(10-a))
ko’a	‘eat’	(unstressed)	unstressed occurrence (2011, p.10:(16-c))
koci	‘sleep’	(unstressed)	unstressed occurrence (2008, p.340:(10-b))
nará	‘cry’	(stressed)	stressed before -ká (2008, p.426:(30-a))
ra’ici	‘speak’	(unstressed)	variable stress (2. or 3.σ) (2008, p.119:(17))
sú	‘sew’	(stressed)	stressed before -sá (2011, p.762:(T-3))
uba	‘sleep’	(unstressed)	unstressed occurrence (2008, p.296:(11-a))
-bú	‘remove’	(stressed)	stressed before ká (2008, p.127:(30-c))

Exceptional Long Allomorph Triggers

a. nakó-**n**-**čan**-a
/nakó-**na**-**čane**-a/
fist.fight-DESID-EV-PROG
'It sounds like they want to fist fight'

(2010:183:(28a))

[[[V] CAUS] MOT (go along)] [X goes along [cause Y to V]]

a.	ma=ti	počí-**ti**-**si**-a
	/ma=ti	počí-**ti**-**si**-a/
	already=1PL.NOM	jump-CAUS-MOT-PROG
	iná-r-ti-po?	
	/iná-ri-ti-po/	

(2010:177:(20a))

Exceptional Long Allomorph Triggers

Word Level:

Input = nako-nale$_{Des}$-cane$_{\sigma Mot}$-C_{cor} a

		DEP C	TEMPSAT	LIN	DEP ↯
	a. nako-nale$_{Des}$-cane$_{Mot}$-C_{cor}a		(*)!		
	b. nako-nale$_{Des}$-cane$_{Mot}$-ta	*!			
	c. nako-nale$_{Des}$-cane$_{Mot}$-a				**!
☞	d. nako-nale$_{Des}$-cane$_{Mot}$-a				*

Input = poci-ti-simi$_{\sigma Mot}$-C_{cor} a

		DEP C	TEMPSAT	LIN	DEP ↯
☞	a. poci-ti-simi$_{\sigma Mot}$-C_{cor} a		(*)		
	b. poci-ti-simi$_{\sigma Mot}$-ta	*!			
	c. poci-ti-simi$_{\sigma Mot}$-C_{cor} a		(*)		*!

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Overview