Phonological reflexes of movement in morphology: An argument for Harmonic Serialism

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Main Claims

- Harmonic Serialist approach in Müller (2020) systematically predicts phonological reflexes of affix movement. Other approaches do not.
- Inflectional exponents have to be merged at the root due to the Strict Cycle Condition.
- Subsequently, movement of exponent helps to satisfy linearization constraint.
- Thus, the model in Müller (2020) is supported by such reflexes.

Background: Reflexes of Movement

Observation:
Reflexes of syntactic movement are ubiquitous:

- syntactic reflexes: reconstruction of binding, theta-role assignment, etc.
- semantic reflexes: reconstruction to intermediate positions (Fox (2000), Nissenbaum (2000))
- morphological reflexes: allomorph selection (McCloskey (1979), Urk (2015), Georgi (2017))
- phonological reflexes: Clements et al. (1983), Korsah & Murphy (2019) on tone

Harmonic Serialism

(1) Harmonic serialism (McCarthy (2010; 2016), Heck & Müller (2013; 2016)):

a. Given some input I_i, the candidate set $CS_i = \{O_{i1}, O_{i2}, \ldots O_{in}\}$ is generated by applying at most *one operation* to I_i.

b. The output O_{ij} with the best constraint profile is selected as optimal.

c. O_{ij} forms the input I_{ij} for the next generation step producing a new candidate set $CS_j = \{O_{ij1}, O_{ij2}, \ldots O_{ijn}\}$.

d. The output O_{ijk} with the best constraint profile is selected as optimal.

e. Candidate set generation stops (i.e., the derivation converges) when the output of an optimization procedure is identical to the input (i.e., when the constraint profile cannot be improved anymore).

Harmonic Serialism in Inflectional Morphology

Assumptions (Müller (2020)):

- Inflectional morphology is realizational, not inferential.
  (See Stump (2001; 2016), Corbett & Fraser (1993), Brown & Hippisley (2012), Halle & Marantz (1993), Noyer (1997).)
- Inflectional morphology is lexical, not inferential.
  (See Halle & Marantz (1993), Trommer (2011) vs. Anderson (1992), Stump (2001).)
- Inflectional morphology is Merge-based, not based on substitution transformations.
  (See Alexiadou & Müller (2008), Bruening (2017) vs. Halle & Marantz (1993), Ackema & Neeleman (2004), Caha (2013), De Clercq & Vanden Wyngaerd (2017).)
- Inflectional morphology is pre-syntactic, not post-syntactic, parallel, or syntax-internal. (The Strict Cycle Condition blocks operations from applying exclusively to embedded domains; Chomsky (1973; 1995; 2008): Post-syntactic morphological exponence by Merge (or by substitution transformation) is inherently counter-cyclic.)

Crucial Assumptions

- Stems in the numeration bear structure-building features.
- Merge Conditions trigger merge of exponents with matching features.
- Ranking of Merge Conditions is determined by the functional sequence (Starke (2001)).
- Additional alignment constraints determine the order of exponents (Trommer (2001; 2008), Ryan (2010)).
- Fully inflected words are transferred to syntax.

Abstract Patterns

In harmonic serialism, morphological movement can arise under iterative optimization when the ranking of two MCs is parallel to the ranking of the respective alignment constraints (and the MCs outrank the alignment constraints). No such movement can occur in standard OT.

(2) a. Initial input:
A stem A with two structure-building features [•α•], [•β•]; [$_\alpha$ B] and [$_\beta$ C] are the exponents that best satisfy faithfulness constraints (compatibility, specificity).

b. Constraints:
$MC_\alpha \gg MC_\beta$; $\alpha\Rightarrow$R, $\beta\Rightarrow$R; L$\Leftarrow$A.

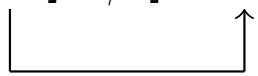
(3) Rankings (i):

a. $MC(\alpha) \gg MC(\beta) \gg L\Leftarrow A \gg \beta\Rightarrow R \gg \alpha\Rightarrow R$

b. $MC(\alpha) \gg MC(\beta) \gg L\Leftarrow A \gg \alpha\Rightarrow R \gg \beta\Rightarrow R$

(4) a. [$_A$ [$_A$ A B_α] C_β]

b. [$_A$ [$_A$ [$_A$ A] C_β] B_α]



(5) Rankings (ii):

a. $MC(\alpha) \gg MC(\beta) \gg A\Rightarrow R \gg L\Leftarrow\beta \gg L\Leftarrow\alpha$

b. $MC(\alpha) \gg MC(\beta) \gg A\Rightarrow R \gg L\Leftarrow\alpha \gg L\Leftarrow\beta$

(6) a. [$_A$ C_β [$_A$ B_α A]]

b. [$_A$ B_α [$_A$ C_β [$_A$ A]]

German Verb Inflection 1

(7) kauf-te-st ← kauf ('buy'), [2], [SG], [PAST]

(8) Harmonic serialism, step 1: Merge of /te/ [PAST]

I_1: $[_V$ kauf]: [•T•], [•Agr•], [2], [SG], [PAST], {[$_T$ /te/↔[PAST]], ... }, {[$_{Agr}$ /st/↔[2.SG]], ... }	MC_T	MC_{Agr}	L⇐V	Agr⇒R	T⇒R
O_{11}: $[_V$ kauf]: [•T•], [•Agr•]	*!	*			
☞O_{12}: $[_V$ kauf-te]: [•Agr•]		*			
O_{13}: $[_V$ kauf-st]: [•T•]	*!				
O_{14}: $[_V$ te-kauf]: [•Agr•]		*	*!		*
O_{15}: $[_V$ st-kauf]: [•T•]	*!		*	*	

(9) Harmonic serialism, step 2: Merge of /st/ [2.SG]

I_{12}: $[_V$ kauf-te]: [•Agr•], [2], [SG], [PAST], { ... }, {[$_{Agr}$ /st/↔[2.SG]], ... }	MC_T	MC_{Agr}	L⇐V	Agr⇒R	T⇒R
O_{121}: $[_V$ kauf-te]: [•Agr•]		*!			
☞O_{122}: $[_V$ $[_V$ kauf-te]-st]					*
O_{123}: $[_V$ st-$[_V$ kauf-te]]			*!	**	

German Verb Inflection 2

(10) Harmonic serialism, step 3: Convergence

I_{122}: [$_V$ [$_V$ kauf-te]-st] [2], [SG], [PAST], { ... }, { ... }	MC_T	MC_{Agr}	L⇐V	Agr⇒R	T⇒R
☞ O_{1221}: [$_V$ [$_V$ kauf-te]-st]					*
O_{1222}: [$_V$ st-[$_V$ kauf-te]]			*!	**	
O_{1223}: [$_V$ te-[$_V$ [$_V$ kauf]-st]]			*!		**
O_{1224}: [$_V$ [$_V$ [$_V$ kauf]-st]-te]				*!	

(11) Derivation in harmonic serialism:

[$_V$ kauf] → [$_V$ [$_V$ kauf] te] → [$_V$ [$_V$ [$_V$ kauf] te] st] → [$_V$ [$_V$ [$_V$ kauf] te] st]

Conclusion:

No movement of exponents.

Berber Verb Inflection 1

(12) ad-y-seg ('FUT-3.MASC.SG-buy'; 'He will buy.') ← seg, [3], [SG], [MASC], [FUT]

Observation (Ouhalla (1991)): T and Agr exponents are prefixes; the surface order is counter-f-seq. (See Noyer (1992), Frampton (2002) for complications: suffixes.)

(13) Harmonic serialism, step 1: Merge of /ad/ [FUT]:

I_1: [$_V$ seg]: [•T•], [•Agr•], [3], [SG], [MASC], [FUT], {[$_T$ /ad/↔[FUT]], ... }, {[$_{Agr}$ /y/↔[3.SG.MASC]], ... }	MC_T	MC_{Agr}	V⇒R	L⇐T	L⇐Agr
O_{11}: [$_V$ seg]: [•T•], [•Agr•]	*!	*			
O_{12}: [$_V$ seg-y]: [•T•]	*!		*	*	
O_{13}: [$_V$ seg-ad]: [•Agr•]		*	*!		*
O_{14}: [$_V$ y-seg]: [•T•]	*!				
☞O_{15}: [$_V$ ad-seg]: [•Agr•]		*			

(14) Harmonic serialism, step 2: Merge of /y/ [3.SG.MASC]

I_{15}: [$_V$ ad-seg]: [•Agr•], [3], [SG], [MASC], [FUT], { ... }, {[$_{Agr}$ /y/↔[3.SG.MASC]], ... }	MC_T	MC_{Agr}	V⇒R	L⇐T	L⇐Agr
O_{151}: [$_V$ ad-seg]: [•Agr•]		*!			
O_{152}: [$_V$ [$_V$ ad-seg]-y]			*!		**
☞O_{153}: [$_V$ y-[$_V$ ad-seg]]				*	

Berber Verb Inflection 2

Note:
There is no competing output that merges /y/ between /ad/ and /seg/, and thereby circumvents a violation of higher-ranked L⇐T in (14) (by violating lower-ranked L⇐Agr). Such a counter-cyclic merge operation would violate the Strict Cycle Condition.

(15) Harmonic serialism, step 3: Movement of /ad/ [FUT]

I_{153}: $[_V$ y-$[_V$ ad-seg]], [3], [SG], [MASC], [FUT], { ... }, { ... }	MC_T	MC_{Agr}	V⇒R	L⇐T	L⇐Agr
O_{1531}: $[_V$ y-$[_V$ ad-seg]]				*!	
☞O_{1532}: $[_V$ ad-$[_V$ y-$[_V$ seg]]]					*
O_{1533}: $[_V$ $[_V$ $[_V$ ad-seg]]-y]			*!		**
O_{1534}: $[_V$ $[_V$ y-$[_V$ seg]]-ad]			*!	**	

(16) Derivation in harmonic serialism:
$[_V$ seg] → $[_V$ ad $[_V$ seg]] → $[_V$ y $[_V$ ad $[_V$ seg]]] → $[_V$ ad $[_V$ y $[_V$ seg]]]

Conclusion:
There is movement of inflectional exponents.

Standard Parallel Optimality Theory

Note:
The same ranking of these constraints predicts direct surface generation (i.e., no movement) in standard parallel optimality theory.

(17) Berber verb inflection in standard parallel optimality theory:

I_1: [$_V$ seg]: [•T•], [•Agr•], [3], [SG], [MASC], [FUT], {[$_T$ /ad/↔[FUT]], ... }, {[$_{Agr}$ /y/↔[3.SG.MASC]], ... }	MC_T	MC_{Agr}	V⇒R	L⇐T	L⇐Agr
O_{11}: [$_V$ seg]: [•T•], [•Agr•]	*!	*			
O_{12}: [$_V$ seg-y]: [•T•]	*!		*		
O_{13}: [$_V$ seg-ad]: [•Agr•]		*	*!		
O_{14}: [$_V$ y-seg]: [•T•]	*!				
O_{15}: [$_V$ ad-seg]: [•Agr•]		*			
☞O_{16}: [$_V$ ad-[$_V$ y-seg]]					*
O_{17}: [$_V$ y-[$_V$ ad-seg]]				*!	
O_{18}: [$_V$ [$_V$ y-seg]-ad]			*!	**	
O_{19}: [$_V$ [$_V$ ad-seg]-y]			*!		**
O_{20}: [$_V$ [$_V$ seg-ad]-y]			*!*	*	**
O_{21}: [$_V$ [$_V$ seg-y]-ad]			*!*	**	*

Cycles

Claim:

- Phonological operations apply to the output of a morphological cycle, and there are *two* morphological cycles:
  1. The first morphological cycle is finished when all MC-triggered Merge operations have applied (i.e., the word is potentially complete for the first time).
  2. The second morphological cycle is finished when the derivation has converged on a final output.
- The characterization of the first morphological cycle as a "potentially complete" word where all structure-building features have been discharged bears an obvious resemblance to Chomsky's (2000) characterization of phases (cf. "a verb phrase in which all θ-roles are assigned"); an analogous reasoning could be provided for the second morphological cycle ("full clause"). See Marvin (2002), Embick (2010).

Barwar Aramaic De-spirantization

In Barwar Aramaic (Iraq, Khan (2008)), a regular local phonological process turns dental fricatives into stops, if they precede coronal sonorants.

(18) De-spirantization
ð,θ → d,t /__ l,n.

(19)

a. [jadli]
/j⟨a⟩ðl-i/
lay.eggs⟨PRS⟩-PL
'They lay eggs.'

b. [ðilla]
/jð⟨i⟩l-la/
lay.eggs⟨PAST⟩-3SG.F.SUBJ
'She laid eggs.'

Overapplication 1

De-spirantization is expectedly triggered if l-initial agreement morphology attaches to θ/ð final stems.

(20) [tʸridle]
/tʸr⟨i⟩ð-le/
chase.away⟨PAST⟩-3SG.SBJ
'He chased away.'

However, it (optionally) overapplies if the REMOTE marker /-wa/ intervenes.

(21) [tʸridwale]∼[tʸriðwale]
/tʸr⟨i⟩ð-wa-le/
chase.away⟨PAST⟩-REMOTE-3SG.SBJ
'He had chased away.'

Overapplication 2

Neither the phoneme [w] nor the affix /-wa/ trigger de-spirantization by themselves.

(22) a. [kaθwa]
/k⟨a⟩θw-a/
write⟨PRS⟩-3SG.F
'She writes.'

b. [ʔiθwa]
/ʔiθ-wa/
be.there-REMOTE
'There was.'

Analysis

Summary:

- The agreement affix merges first, followed by /-wa/.
- In a first phonological cycle de-spirantization applies locally.
- Agreement moves across /-wa/ to the right edge, making de-spirantization opaque.

(23)
a. tʸrið-le-wa
b. tʸrid-le-wa
c. tʸrid- -wa-le

First morphological cycle 1

- $\mathrm{MC}_{\mathrm{Agr}}$, which triggers the insertion of agreement morphology, outranks $\mathrm{MC}_{\mathrm{Adv:T}}$ which is responsible for the merging of /-wa/.
- Therefore, /-le/ is merged first

(24) Harmonic serialism, step 1: Merge of /le/ [3..SG.MASC]

I_1: $[_V$ tʸr⟨i⟩ð]: [•Agr•], [•Adv:T•], [3], [SG], [MASC] [PAST], {[$_{\mathrm{Agr}}$ /le/↔[3.SG.MASC]], … }, {[$_{\mathrm{Adv:T}}$ /wa/↔[REMOTE]], … }	$\mathrm{MC}_{\mathrm{Agr}}$	$\mathrm{MC}_{\mathrm{Adv:T}}$	L⇐V	Agr⇒R	Adv:T⇒R
O_{11}: $[_V$ tʸr⟨i⟩ð]: [•Agr•], [•Adv:T•]	*!	*			
☞O_{12}: $[_V$ $[_V$ tʸr⟨i⟩ð]-le]: [•Adv:T•]		*			
O_{13}: $[_V$ $[_V$ tʸr⟨i⟩ð]-wa]: [•Agr•]	*!				
O_{14}: $[_V$ le-$[_V$ tʸr⟨i⟩ð]]: [•Adv:T•]		*	*!	*	
O_{15}: $[_V$ wa-$[_V$ tʸr⟨i⟩ð]]: [•Agr•]	*!		*		*

First morphological cycle 2

- At the next step, /-wa/ is merged.
- this necessarily induces a violation of Agr⇒R because
  - interfixing /-wa/ between the root and /-le/ is impossible due to strict cyclicity.
  - suffixing /-wa/ and moving /-le/ across it would involve two operations.
  - prefixing /-wa/ to the stem violates higher ranked L⇒ V

(25) Harmonic serialism, step 2: Merge of /wa/ [REMOTE]

I_{12}: [V [V tʸr⟨i⟩ð]-le]: [•Adv:T•], [3], [SG], [MASC] [PAST], { ... }, {[Adv:T /wa/↔[REMOTE]], ... }	MC_{Agr}	$MC_{Adv:T}$	L⇐V	Agr⇒R	Adv:T⇒R
O_{121}: [V [V tʸr⟨i⟩ð]-le]: [•Adv:T•]		*!			
☞O_{122}: [V [V [V tʸr⟨i⟩ð]-le]-wa]				*	
O_{123}: [V wa-[V [V tʸr⟨i⟩ð]-le]]			*!		**

Phonological cycle

- All merge conditions are satisfied, so that the first cycle of phonological computation is triggered.
- The exact nature of the phonological computation is not crucial – It can be rules, globally optimising constraints, or HS as well.
- Morphological brackets must not be erased.

(26) [[[tʸr⟨i⟩ð]-le]-wa] → [[[tʸr⟨i⟩d]-le]-wa]

- The output is shipped back to morphology.

Second Morphological cycle

In the next morphological cycle, the lower ranked linearization constraints can induce movement.

- Agr⇒R outranks Adv:T⇒R.
- Movement of /-le/ across /-wa/ thus improves the violation profile.

(27) Harmonic serialism, step 3: Movement of /le/ [3..SG.MASC]

I_{122}: [V [V [V tʸr⟨i⟩d]-le]-wa] [3], [SG], [MASC] [PAST], { ... }, { ... }	MC_{Agr}	$MC_{Adv:T}$	L⇐V	Agr⇒R	Adv:T⇒R
O_{1221}: [V [V [V tʸr⟨i⟩d]-le]-wa]				*!	
☞O_{1222}: [V [V [V [V tʸr⟨i⟩d]]-wa]-le]					*
O_{1223}: [V wa-[V [V tʸr⟨i⟩d]-le]]			*!		**
O_{1224}: [V le-[V [V tʸr⟨i⟩d]]-wa]			*!	**	

- The next step is convergence, the morphological computation is finished and a new cycle of phonology is induced.
- Morphological movement counterbleeds de-spirantization.

Prediction

There should be no overapplication if the affix intervening between subject agreement and the root is merged before subject agreeement, i. e. is below it on the f-seq. This is indeed the case — object agreement transparently blocks de-spirantization.

(28) [tʸriðale] *[tʸridale]
/tʸr⟨i⟩ð-a-le/
chase.away⟨PAST⟩-F.OBJ-3SG.M.SBJ
'He chased her away.'

Sanskrit ruki-rule

In Sanskrit, the ruki-rule applies non-locally across the tense prefix /a-/ (Kiparsky 1982).

(29) Ruki-rule

s → ʂ/ {r,u,k,i}__

(30)

a. siñc- 'sprinkle'

b. abhi-ʂiñc- 'anoint', 'pour on' (compound verb)

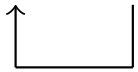
c. abhy-a-ʂiñc-at 'anointed', 'poured on' (IMPERFECTIVE, 3SG)'

(31)

a. a-abhi-siñc — abhi merges first

b. a-abhi-ʂiñc — ruki-rule

c. abhi-a- -ʂiñc — abhi moves across a



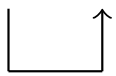
Lithuanian accent shift

In Lithuanian, Saussurean accent shift applies across an unaccented mora, iff it belongs to a theme vowel (Kushnir 2018).

(32) Saussurean Accent Shift
Whenever two underlying accents coincide on two subsequent moras word-finally, the surface accent is aligned with the right edge of the word.

(33)
a. $\text{ká}_\mu\text{i}_\mu\text{m} + \text{é}_\mu \rightarrow$ káim-e (No accent shift)
b. $\text{ra}_\mu\text{ń}_\mu\text{k} + \text{á}_\mu \rightarrow$ ranká (transparent accent shift)
c. žín $+ \text{a}_\mu +$ ú $\rightarrow$ žinaú (Opaque accent shift)

(34)
a. žín-ú only agreement merges
b. žin-ú Accent shift
c. žín-ú-a Theme vowel merges
d. žin- -a-ú Agr moves across theme vowel



Kazakh vowel harmony

In Kazakh, the invariant [+front] affix /-men/ does not block root-controlled vowel harmony from targeting the question particle /-BA/ across itself (Bowman & Lokshin 2014). The vowel /e/ is not generally transparent.

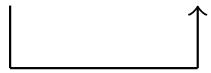
(35) a. bʊl ʃal nan-men-ba
bʊl ʃal nan-men-bA
this old.man bread-INSTR-Q
'Is this an old man with some bread?'

b. bʊl ʃal bøbek-men-be
bʊl ʃal bøbek-men-bA
this old.man baby-INSTR-Q
'Is this an old man with a baby?'

(36) a. nan-BA-men — Q merges before INSTR

b. nan-ba-men — Vowel harmony

c. nan- -men-ba — Q moves across INSTR



Epenthesis in Quechua

Overview: In Bolivian and Huallaga Quechua, epenthesis of CV applies even though morphological exponents that would trigger it are separated by other exponents (see Bills et al. (1969), Weber (1989), and Myler (2013)).

(37) a. *Affix$_1$-Affix$_3$ is ruled out and epenthesis applies Affix$_1$-CV-Affix$_3$
b. Affix$_1$-CV-Affix$_2$-Affix$_3$
c. Affix$_1$-Affix$_2$

Conditions on epenthesis

Ni is inserted to prevent creation of super-heavy syllables, i.e., syllables which nucleus and coda have three or more moras (Myler (2013)). V/C – μ; V: – $\mu\mu$.

(38) a. Allowed: CV CVC CV:
b. Prohibited: CV:C(C*) CVCC(C*)

(39) Huallaga Quechua, -C

a. uma-n
head-3.POSS
'his head'

b. mayur-ni-n
older-NI-3.POSS
'my older (sibling)'

c. papa:-ni-n
father-NI-3.POSS
'his father'

Note: /ll/ stands for a lamino-palatal lateral, /lla/ 'just' does not trigger *ni*-insertion:

(40) chay-yaq-lla
that-LIM-just
'just to there'

Overapplication in Quechua

Ni can be also present when two affixes that create environment for its insertion are separated by another exponent *lla* 'just'.

(41) Bolivian Quechua

a. *wawa-s-y
child-PL-1POSS
'my children'

b. wawa-s-ni-y
child-PL-NI-1POSS

c. *wawa-s-lla-y
child-PL-just-1.POSS
'just my children'

d. wawa-s-ni-lla-y
child-PL-NI-just-1.POSS

(42) Huallaga Quechua

a. *kikish-yki
armpit-2.POSS
'your armpit'

b. kikish-ni-ki
armpit-NI-2.POSS

c. kikish-ni-lla-yki
armpit-NI-just-2.POSS
'just your armpit'

d. kikish-lla-yki
armpit-just-2.POSS

Note 1: /yki/ used starts with two consonants, but the glide is deleted after /i/.
Note 2: Complex syllable onsets are also ruled out (i.e., *CCV).

Analysis of *ni*-insertion

Claim: *Ni*-insertion always applies locally when exponents creating a super-heavy syllable are adjacent to each other. The configuration is later destroyed by movement of the possessive affix.

Constraints and their ranking:

- [Poss] is part of the f-seq of nominal categories, while optional exponents like *lla* 'just' are not. $\rightsquigarrow \text{MC}_{\text{Poss}} \gg \text{MC}_{\text{Lim(itiation)}}$
- Alignment constraints are ranked in the same way: $\rightsquigarrow$ Poss⇒R $\gg$ Lim⇒R
- L⇐N ensures that exponents are suffixal, it outranks other alignment constraints.

Derivation of *ni*-epenthesis, Bolivian Quechua 1

(43) Harmonic serialism, step 1: Merge of /y/ [1.POSS]

I_1: [$_N$ wawa-s]: [•Poss•], [•Lim•], [PL], [1.POSS], {[$_{Poss}$ /y/↔[1.POSS]], … }, {[$_{Lim}$ /lla/↔[JUST]], … }	MC_{Poss}	MC_{Lim}	L⇐N	Poss⇒R	Lim⇒R
O_{11}: [$_N$ wawa-s]: [•Poss•], [•Lim•]	*!	*			
☞O_{12}: [$_N$ [$_N$ wawa-s]-y]: [•Lim•]		*			
O_{13}: [$_N$ [$_N$ wawa-s]-lla]: [•Poss•]	*!				
O_{14}: [$_N$ y-[$_N$ wawa-s]]: [•Lim•]		*	*!	**	

(44) Harmonic serialism, step 2: Merge of /lla/ [LIM]

I_{12}: [$_N$ [$_N$ wawa-s]-y]: [•Lim•], [PL], [1.POSS], { … }, {[$_{Lim}$ /lla/↔[JUST]], … }	MC_{Poss}	MC_{Lim}	L⇐N	Poss⇒R	Lim⇒R
O_{121}: [$_N$ [$_N$ wawa-s]-y]: [•Lim•]		*!			
☞O_{122}: [$_N$ [$_N$ [$_N$ wawa-s]-y]-lla]				*	
O_{123}: [$_N$ lla-[$_N$ [$_N$ wawa-s]-y]]			*!		***

At this point, all MCs are satisfied and the first morphological cycle is completed!

Derivation of *ni*-epenthesis, Bolivian Quechua 2

The output of the first morphological cycle [$_N$ [$_N$ [$_N$ wawa-s]-y]-lla] is subject to phonological operations.

(45) *Ni* breaks a super-heavy syllable
wawa-s-y-lla ⟶ wawa-s-ni-y-lla

After this, the morphological derivation continues:

(46) Harmonic serialism, step 3: Movement of /y/ [1.POSS]

I_{122}: [$_N$ [$_N$ [$_N$ wawa-s]-ni-y]-lla], [PL], [1.POSS], { ... }, { ... }	MC_{Poss}	MC_{Lim}	L⇐N	Poss⇒R	Lim⇒R
O_{1221}: [$_N$ [$_N$ [$_N$ wawa-s]-ni-y]-lla]				*!	
☞O_{1222}: [$_N$ [$_N$ [$_N$ [$_N$ wawa-s]-ni-]-lla]-y]					*
O_{1223}: [$_N$ lla- [$_N$ [$_N$ [$_N$ wawa-s]-ni-]-y]]			*!		***

Summary: Seemingly non-local epenthesis is analyzed as strictly local operation followed by movement of the possessive exponent.

Alternative approaches 1

Non-local phonology: Agreement by Correspondence (see Hansson (2001), Rose & Walker (2004), Rhodes (2012))

Summary:

- Non-local processes are derived by establishing correspondence between the undergoing segments and forcing them to agree in some feature values.
- The (possibly linearly intervening) segment that neither undergoes nor blocks the process stays outside of the correspondence class due to a special diacritic (see Bowman & Lokshin (2014) on non-local vowel harmony in Kazakh).

Discussion:

- It's not immediately clear whether the approach can be applied to epenthesis or accent shift.
- Modularity is weakened or even absent: Phonological processes access a diacritic without any phonological content.
- Non-local phonology is assumed as a default.

Alternative approaches 2

Counter-Cyclic Movement in Morphology and Interfixation

Summary:

- Phonology applies locally; an intervening segment is inserted later.

Discussion:

- Interfixation (Kiparsky (1982; 2017), Hyman (1994; 2002; 2003), Kushnir (2018)): It incurs a clear violation of the Strict Cycle Condition.
- Lowering (Myler (2013)): Under standard assumptions (see Embick & Noyer (2001)), it applies before linearization and vocabulary insertion, i.e., morphemes in their non-lowered order have no phonological features, so that no phonological interaction between them is possible.
- Local Dislocation:
  - There is no well-defined trigger for dislocating exponents.
  - Assumptions needed to derive non-local processes are incompatible with previously established applications of LD; see the positioning of reflexive *si* in Lithuanian (Embick & Noyer (2001; 2007), Embick (2007)).

Alternative approaches 3

Novel algorithm of vocabulary insertion (Myler (2017))

Summary:

- Relevant configurations exhibit counter-scopal morpheme order and are derived by movement of a syntactic object into the specifier of a higher head.
- Vocabulary insertion counts depth of embedding by a number of categorially distinct maximal projections so that a specifier of a given head receives phonological features before the head itself. This allows processes between the specifier and the complement to apply locally.

Discussion:

- The approach allows for non-local phonological processes in configurations that are not derived by movement.
- Syntactic movement has to apply without a clear trigger.

Alternative approaches 4

Base-derivative faithfulness (Benua (1997), Kenstowicz (2002), Albright (2002))

Summary:

- A form with local application of a phonological process is the base for the derivation of the form containing the intervening affix. Faithfulness to the base is ranked high so that processes applies without a phonological context.

Discussion:

- There is no justification for choosing the required form as a base.
- Unless forms of a single word have distinct bases (*pace* Albright (2002)), phonological processes are wrongly predicted to apply across any intervener.

Stratal OT with constraint re-ranking

Summary:

- Affixes are adjacent and phonology applies locally at an earlier stratum. Order is changed at a later stratum, while the phonological effects are preserved.

Discussion:

- To the best of our knowledge, such an analysis was not yet proposed.
- The approach is essentially very similar to the current one in having two morphological cycles interleaved with phonological processes, but it additionally involves re-ranking of constraints.

Conclusions

1. Strictly local phonological processes apply seemingly non-locally across an intervening exponent. The data come from:
   - De-spirantization in Barwar Aramaic;
   - *ruki* rule application in Sanskrit;
   - Saussurean accent shift in Lithuanian;
   - Vowel harmony in Kazakh
   - Syllable epenthesis in Quechua;
2. We argue that these patterns are best analyzed as phonological reflexes of movement in morphology.
3. In harmonic serialism, morphological movement arises when the ranking of two MCs is parallel to the ranking of the respective alignment constraints (and the MCs outrank the alignment constraints).
4. Phonological operations apply to the output of the first morphological cycle that is completed when all MC-triggered Merge operations have applied.

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