Gradualness and Fell-Swoop Derivations

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1.0 Introduction

A recently revived debate on simultaneity, iterativity, and gradualness in derivations (McCarthy 2006, 2007, 2008, to appear, and citations therein).

Question:
Are there limits on modifications that can be made in a step of a derivation?

A possible answer: Gradualness
Only one violation of a single basic faithfulness constraint (McCarthy 2007).

(1) **Goals of this talk**
- Examine an apparently non-gradual vowel harmony.
- Propose a revised statement of Gradualness.

(2) **Organization**
§2 • Background on OT with candidate chains (OT-CC) (McCarthy 2007).
§3 • An empirical problem for Gradualness: Central Venetan.
• Diagnosing the problem and a possible solution.
§4 • Conclusion.

2.0 Background: OT-CC

(3) **Candidate Chains** (McCarthy 2007:60)
- A candidate chain is an ordered *n*-tuple that connects the input with the output through a sequence of intermediate forms.
- Each intermediate form differs minimally from the forms that immediately precede and follow it.
- The last member of a chain is its output.

(4) **Notation:** The operation of progressive nasal harmony in Johore Malay
a. Chain: <pəŋawasan, pəŋãwasan, pəŋãw̃asan, pəŋãw̃ãsan>
b. Output: [pəŋãw̃ãsan] 'supervision' (Walker 2000)

(5) **Well-formedness conditions on chains** (McCarthy 2007:4, 61)
a. *Faithful first member*
The first form in a chain is identical with the input except for syllabification and the like—it violates no faithfulness constraints.
b. *Gradualness*
Successive forms of a chain are minimally different from their neighbors, so the path from input to output proceeds in small steps.
c. *Local optimality*
i. *Harmonic improvement*: Every noninitial form in a chain is more harmonic that its predecessor, relative to the constraint hierarchy of the language in question.
ii. *Best violation*: Every noninitial form in a chain is more harmonic than every other form that can be derived by violating the same basic faithfulness constraint.

(6) **OT with candidate chains (OT-CC)**
- A derivative of Harmonic Serialism (Prince & Smolensky 2004), also known as Persistent OT (McCarthy 2006).
- *Restraint of analysis*: Derivations progress towards improved harmony with respect to EVAL via successive stages of harmonic improvement.
- GEN is persistent. It generates successive forms in the chain. It loops with EVAL to assess whether a particular alteration results in local optimality.

(7) **More on Gradualness** (McCarthy 2007:77-9)
- Successive forms in a chain must monotonically increase in unfaithfulness to the input.
- The monotonic increase has a slope of one localized unfaithful mapping per form in the chain.
- A localized unfaithful mapping brings a localized single violation of one basic faithfulness constraint.
- Basic faithfulness constraints are:
  - MAX(*x*), DEP(*x*) (prohibit deletion or insertion of elements of type *x*).
  - IDENT(*f*) (prohibits changing attribute *f*).[1]
  - Possibly a few others.

[1] McCarthy (to appear) proposes to substitute MAX(Place) for IDENT(Place) in the assessment of Gradualness. But he tentatively postulates that a MAX(F) constraint exists for Place only (p. 18).

(8) **A consequence of Gradualness**:

Phonological processes do not exist that incur more than one violation of a basic faithfulness constraint within a derivational step.

Example: Vimeu Picard (José & Auger 2004)

A Romance language closely related to French, spoken in parts of France and Belgium.

(9) Final obstruent stops contrast in voicing

wep	'wasp'	tapɛt	'mouse trap'
tyb	'pipe'	berlœd	'old ewe'

(10) Bilabial and coronal voiced stops in codas become nasals when adjacent to a nasal vowel or consonant. Underlying forms after José & Auger, superscript 'n' represents a floating nasal.

	Coda	Onset
a. /repɔ^{n}d/ →	[repɔ̃n] *réponne* 'to answer'	/repɔ^{n}dy/ → [repɔ̃dy] *répondu* 'answered'
b. /rydmɛ^{n}/ →	[rynmɛ̃] *rudemint* 'roughly'	/ryd/ → [ryd] *rude* 'rough'
c. /ga^{n}b/ →	[gãm] *gamme* 'leg'	/ga^{n}be/ → [gãbe] *gambet* 'action of kicking one's leg over the head of a young/short/little person'

(11) **Analysis**: ***VOIOBS**

- José & Auger propose that the voiced stop nasalization is driven by a constraint against voiced obstruents (*VOIOBS).
- Vimeu Picard spreads [+nasal] in the vicinity of voiced stops to convert them to nasals where possible.

(12) Illustration:

repɔ̃d →	repɔ̃n	
|	|/	
[+nas]	[+nas]	

(13) Core ranking:

$\text{IDENT}_{\text{ONS}}$(nasal) >> *VOIOBS >> IDENT(nasal)

(as re-interpreted by McCarthy 2006)

- IDENT(voice), DEP(nasal) >> *VOIOBS prevents devoicing or introduction of a [+nasal] feature.

(14) **The Gradualness issue** (McCarthy 2006)

- *VOIOBS favors hypothetical /mad/ → [mãn]
- Nasal spreading that originates at a distance from the target stop does not seem to occur in Vimeu Picard.

(15) **Classic OT: Fell-swoop candidate**

mad →	mãn
|	\ | /
[+nas]	[+nas]

(16) **OT-CC with Gradualness**

mad →	mãd →	mãn
|	\/	\ | /
[+nas]	[+nas]	[+nas]

- *VOIOBS does not favor [mãd]. Hence it is not a possible successive form in a chain initiated by [mad] in Vimeu Picard's grammar.

(17) Discussion by McCarthy (2006:213)

- mad → mãd could be prevented by another constraint dominating *VOIOBS.
- But "it is likely that no language could do what Vimeu Picard does not do. That is, the local advantage of avoiding a violation of *VCDOBST cannot be achieved by long-distance spreading in any language."

Next section:

Central Venetan appears to actually present a case of long-distance spreading with local advantage.

3.0 Central Venetan and Gradualness

3.1 The problem presented by central Venetan

Central Venetan dialect (Romance; Walker 2005)
Spoken in provinces of Padova, Rovigo, and Vicenza, and parts of Verona.

(18)

Stressed vowels	Unstressed vowels
[i e ɛ a ɔ o u]	[i e a o u]

(19) A high vowel causes /e, o/ to raise to [i, u] in a preceding stressed syllable.

kals-ét-o	kals-**í**t-i	‘sock (m sg/pl)’
kant-é-se	kant-**í**-si-mo	‘sing (1 pl/1 pl impf. subj.)’
móv-o	m**ú**v-i	‘move (1 sg/2 sg)’
kantór	kant**ú**r-i	‘choir singer (m sg/m pl)’

(20) Raising does not affect /ɛ, ɔ, a/; /a/ blocks harmony between a final high vowel and an antepenultimate mid vowel.

gát-o	g**á**t-i	‘cat (m sg/pl)’
la(v)ór-a-v-a	la(v)**ó**r-a-v-i	‘worked, was working
	*la(v)**ú**r-a-v-i	(1 sg/2 sg impf. ind.)’

(21) When stress is antepenultimate, an intervening mid vowel can raise.

órdeno	**ú**rd**i**ni	*úrd**e**ni	‘order (1 sg/2 sg)’

(22) Raising in an unstressed mid penult vowel occurs only when a stressed vowel undergoes raising.

ángol-o	áng**o**l-i	*áng**u**l-i	‘angle (m sg/pl)’
áxen-o	áx**e**n-i	*áx**i**n-i	‘donkey (m sg/pl)’
pérseg-o	pérs**e**g-i	*pérs**i**g-i	‘peach (fruit) (m sg/pl)’

Central Venetan’s harmony is “non-myopic” (cf. Wilson 2003)
- It occurs only if assimilation happens in the stressed syllable.
- Otherwise the penultimate unstressed mid vowel does not undergo raising, even though it has the capacity to do so.
- I’ll refer to this as a *telescoping fell-swoop derivation*.

(23) **Harmony imperative** (Walker 2005)
Central Venetan’s harmony is driven by a licensing constraint requiring that [+high] in a post-tonic vowel be associated with the stressed syllable.
(Post-tonic = post-stress.)

(24) **Problem**
The gradualness condition will prevent raising in (21) if the derivation proceeds by assimilation through the penult vowel.

a. <ordeni, **ó**rdeni, **úrdi**ni> *Violates Gradualness*
The telescoping fell-swoop step from **órdeni** to **úrdini** contains two localized unfaithful mappings: IDENT(high)@1 (o→u) and IDENT(high)@4 (e→i).

b. <ordeni, **ó**rdeni, órd**i**ni, **ú**rdini> *Not harmonically improving*
The step from **órdeni** to **órdini** does not improve with respect to the language’s constraint hierarchy, as evident from the lack of raising in (22).

3.2 The simultaneous solution

- To admit (24a), simultaneous violations of faithfulness are needed.
- Restricted by Gradualness.

(25) **Prior research on simultaneous violations of faithfulness**

a. *For different basic faithfulness constraints*
- Prevention necessary to obtain counterfeeding opacity involving epenthesis and raising in Bedouin Arabic (McCarthy 2007:106, 109).
- If admitted, this would mimic simultaneous application of two rules that make distinct types of changes.

b. *For same basic faithfulness constraint to reduce markedness at multiple loci*
- Prevention necessary to obtain metrically-conditioned syncope in Awajún (aka Aguaruna) which relies on iterative stress assignment (McCarthy 2008).
- If admitted, this would mimic simultaneous application of a rule at every location where its structural description is met (Anderson 1974, Chomsky & Halle 1968).

Preventing Gradualness of types (25a-b) seems essential (otherwise too few solutions).[2]

[2] But Anderson (1974:230-4) argues that multiple application of the type in (25b) is needed for accent deletion in Acoma. Reconciling this case with McCarthy’s study of Awajún requires further investigation.

(25) **Prior research on simultaneous violations of faithfulness (continued)**

c. *For same basic faithfulness constraint to reduce markedness at a single locus*

- Prevention is advantageous for voiced stop nasalization in Vimeu Picard but not essential (McCarthy 2006).
- Prevention advantageous in ruling out an apparently unattested truncation pattern in response to FINAL-C (McCarthy 2007:85).
- If admitted, this would mimic application of a rule that can alter more than one element at once. Specifically, the rule would have a single target with other elements altered only as needed in attaining that target.

Preventing Gradualness of type (25c) does not seem essential (but helps address too-many-solutions).

Too restrictive: Gradualness of type (25c) rules out central Venetan.

(26) **Proposed solution:** *Simultaneous approach* (McCarthy 2008)

- Allow GEN to simultaneously add multiple violations of a single basic faithfulness constraint. This would permit the fell-swoop step in (24a): <…, **ó**rdeni, **ú**rdi**n**i>.
  - Revision to definition of Localized Unfaithful Mapping.
- Minimize the occurrence of multiple violations to just those needed to achieve some degree of harmonic improvement.
  - Revision to definition of Candidate Chain.

(27) **Gradualness** (repeated from (7))

- Successive forms in a chain must monotonically increase in unfaithfulness to the input.
- The monotonic increase has a slope of one localized unfaithful mapping per form in the chain.

- **Localized unfaithful mapping**: A localized unfaithful mapping brings a localized single violation of one basic faithfulness constraint.

(28) **Localized unfaithful mapping (revised)**

A localized unfaithful mapping brings *localized violation(s)* of one basic faithfulness constraint.

(29) **Well-formedness conditions on chains** (from (5))

a. *Faithful first member*

b. *Gradualness*

c. *Local optimality*
   i. *Harmonic improvement*: Every noninitial form in a chain is more harmonic that its predecessor, relative to the constraint hierarchy of the language in question.
   ii. *Best violation*: Every noninitial form in a chain is more harmonic than every other form that can be derived by violating the same basic faithfulness constraint.

(30) **Issues necessitating revision to local optimality**

- Multiple violations of a single basic faithfulness constraint are now permitted, but ones that reduce markedness at multiple loci need to be prevented.
  - Solution: Favor fewer violations of faithfulness.
- The best violation condition could promote fell-swoop derivations whether they reduce markedness at a single locus (as desired) or multiple loci (unwanted).
  - Solution: Prioritize fewer faithfulness violations over best violation.

(31) **Local optimality (revised)** (revisions in italics)

i. Harmonic improvement
Every noninitial form in a chain is more harmonic that its predecessor, relative to the constraint hierarchy of the language in question.

ii. Fewer violations
Every non-initial form in a chain has no more violations of a given basic faithfulness constraint than any other form that can be derived by violating the same basic faithfulness constraint and that respects harmonic improvement and gradualness.

iii. Best violation
Every noninitial form in a chain is more harmonic than every other form that can be derived by violating the same basic faithfulness constraint.

iv. Fewer violations trump best violation

(32) **Definition: Candidate Chain** (adapted from McCarthy 2007:62)
(with revisions in italics)
A candidate chain associated with an input /in/ in a language with the constraint hierarchy $\mathcal{H}$ is an ordered *n*-tuple of forms C = $<f_0, f_1, \ldots, f_n>$ that meets the following conditions.

Initial form:
f_0 is the faithful parse of /in/ that is most harmonic with respect to $\mathcal{H}$.

Gradualness:
In every pair of immediately successive forms in C, $< \ldots, f_i, f_{i+1}, \ldots>$ $(0 \leq i < n)$, f_{i+1} has all of f_i's localized unfaithful mappings relative to /in/, plus one more.

Local optimality

a. **Harmonic improvement:**
For every pair of immediately successive forms in C, $< \ldots, f_i, f_{i+1}, \ldots>$ $(0 \leq i < n)$, where F is the basic faithfulness constraint violated by the localized unfaithful mapping that distinguishes f_{i+1} from f_i, f_{i+1} is more harmonic according to $\mathcal{H}$ than f_i.

b. **Best violation:**
For every pair of immediately successive forms in C, $< \ldots, f_i, f_{i+1}, \ldots>$ $(0 \leq i < n)$, where F is the basic faithfulness constraint violated by the localized unfaithful *mapping(s)* that distinguish f_{i+1} from f_i, f_{i+1} is more harmonic according to $\mathcal{H}$ than every other form that differs from f_i by different F-violating localized unfaithful *mapping(s)*.

c.. ***Fewer violations:***
For every pair of immediately successive forms in C, $< \ldots, f_i, f_{i+1}, \ldots>$ $(0 \leq i < n)$, where F is the basic faithfulness constraint violated by the localized unfaithful mapping(s) that distinguish f_{i+1} from f_i, f_{i+1} has no more violations of F than any other form that respects harmonic improvement and gradualness and differs from f_i by localized unfaithful mapping(s) that violate F.

d. ***Fewer faithfulness violations trump best violation:***
Let α and β be harmonically improving forms that differ from f_i by F-violating localized unfaithful mapping(s). If α has fewer violations of F than β, then $f_{i+1} \neq \beta$.

(33) **Summary**

- Formal modifications are required to accommodate telescoping fell-swoop derivations.
- Localized unfaithful mapping: Can bring more than one violation of a single basic faithfulness constraint.
- Candidate chain definition:
  - Derivational steps limit faithfulness violations to the fewest needed to achieve some harmonic improvement.
  - Limiting faithfulness violations is prioritized over best violation.

3.3 Application to central Venetan

Recall:

(34) a. A high vowel causes /e, o/ to raise in a preceding stressed syllable.

kalséto	kalsíti	'sock (m sg/pl)'
móvo	múvi	'move (1 sg/2 sg)'

b. Intervening /a/ is a blocker.

la(v)órava	la(v)óravi	'worked, was working (1 sg/2 sg impf. ind.)'

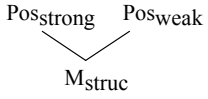
c. An intervening mid vowel undergoes raising.

órdeno	úrdini	'order (1 sg/2 sg)'

d. If the stressed antepenult does not raise, a mid penult does not either.

ángolo	ángoli	'angle (m sg/pl)'

(35) **Analysis as indirect licensing:**
Marked structure in a weak position must be licensed by membership in a strong position (Steriade 1995, Walker 2005, see also Itô 1988, Goldsmith 1990, Lombardi 1994).



(36) **LICENSE([+high]$_{\text{post-tonic}}$/σ́)**
[+high] in a post-tonic syllable must be associated with a stressed syllable (Walker 2005).

(37) **Core ranking:**

Licensing causes vowel raising

IDENT(low) >> LICENSE([+high]$_{post\text{-}tonic}$/ó) >> IDENT(high)

Low vowels block licensing

(38) Harmony affects an intervening mid vowel

/ordeni/	IDENT(low)	LIC([+high]/ó)	IDENT(high)
a. <ordeni>		*!	
b. <ordeni, **ó**rdeni>		*!	
☞c. <ordeni, **ó**rdeni, **ú**rd**i**ni>			**

- Candidates (b-c) violate IDENT(stress) (McCarthy 2008), not shown here.
- Candidate (c), with a telescoping fell-swoop derivation, is admitted under the revised version of Gradualness, but not its prior formulation.
- On control of harmony by the post-tonic vowel, and the retention of [+high] when licensing does not succeed, see Walker (2005).

(39) **No harmony in absence of target**
- <…, **á**ngoli, áng**u**li> is not harmonically improving. It does not improve satisfaction of the licensing constraint.

(40) **Low vowel blocking**
- <…, lav**ó**ravi, lav**úri**vi > is not harmonically-improving because it violates IDENT(low).

(41) **Locality**
Feature spreading occurs only between segments that are articulatorily adjacent (Gafos 1999, Walker 2000, Ní Chiosáin & Padgett 2001, among others).

*lav**ú**rav**i**
\ /
[+high]

(42) **Analytical results**
- Initiation of harmony occurs when a viable target is sighted at-a-distance.
- No harmony initiated when stressed vowel is prevented from assimilating.
- Intervening non-undergoers block harmony.

3.4 A gradual alternative?

(43) **A conceivable alternative solution**
- Similar harmony patterns exist where harmony between a final vowel and a stressed antepenultimate vowel operates across a transparent penult.
- This has provoked a proposal for harmony-at-a-distance via copied features (Walker 2004).
- Could those representations solve the problem by allowing a chain where harmony in the antepenult *precedes* assimilation in the penult?

(44) **Gradual chain steps**

ó r d e n i → ú r d e n i → ú r d i n i
| | | | | |
[+hi] [+hi]$_i$ [+hi]$_i$ [+hi]$_i$ [+hi]$_i$ [+hi]$_i$

This possibility is explored in the appendix but proves unsuccessful.

In short:
- The approach in question could generate a chain like that in (44), but it erroneously predicts that /a/ will be transparent.
- Other conceptual problems exist, on which see the appendix.

4.0 Conclusion

(45) **Empirical result**
- Telescoping fell-swoop derivations *do* exist.
- They reduce markedness at a single locus.
- The locus of markedness and the source of its repair are non-local.
- Intervening material is altered in the course of achieving the markedness reduction.

(46) **Implications for Gradualness**
- Multiple violations of a single basic faithfulness constraint are admissible in a single derivational step.
- Candidate chain generation limits faithfulness violations to the minimum needed to achieve any degree of harmonic improvement.
- More theory testing and evaluation is needed, especially for interaction of processes that incur violations of the same basic faithfulness constraint.

Appendix: A conceivable gradual alternative (see §3.4)

Lena Asturian (Hualde 1989, 1998)

(47) A high vowel suffix (m sg) raises stressed mid vowels to high and stressed low vowels to mid.

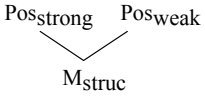
kordéros	kordíru	‘lamb (m pl/m sg)’
féa	fiu	‘ugly (f sg count/m sg count)’
reóndo	reúndu	‘round (mass/m sg count)’
tsamárga	tsamérgu	‘muddy lake (f sg/m sg)’

(48) Under antepenultimate stress, a final high vowel causes raising across an unaffected nonhigh penult.

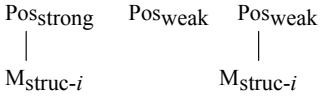
burwébanos	burwíbanu	‘wild strawberry (m pl/m sg)’
páʃara	péʃaru	‘bird (f sg/m sg)’

(49) **Relevant licensing configurations** (Walker 2004)

a. Indirect Licensing



b. Identity Licensing



- Indirect licensing satisfies licensing through spreading to the strong position.
- Identity licensing satisfies licensing through duplication of a corresponding feature in the strong position.

(50) **Chain:**
Let X be an element belonging to a given representation R. Then X’s chain is composed of X and all its correspondent elements within R.
(N.B. This construct is distinct from a candidate chain.)

(51) **Generalized Licensing:**
Let M_{struc} be a given type of marked structure, Pos_{strong} be a given type of strong position, and R be a phonological representation.

M_{struc}/Pos_{strong}
For any instance of M_{struc} in R, some element of its chain belongs to Pos_{strong}.

(52) **LICENSE(Height)-in-$V_{[+high]}$/σ́**
For any occurrence of [high] or [low] in a high vowel in a word, some member of that feature’s chain belongs to a stressed syllable.[3]

(53) **INTEGRITY-IO** (McCarthy & Prince 1995)
No element of the input has multiple correspondents in the output.

- Violated by feature duplication.

(54) Transparent penult: LICENSE(height)/σ́ >> IDENT-IO(height) >> INTEGRITY

/paʃaru/	LICENSE (height)/σ́	IDENT(height)	INTEGRITY
☞ a. <paʃaru, páʃaru, péʃaru>	*	*	*
b. <paʃaru, páʃaru>	**!		

- [péʃaru] represents a form with identity licensing, where [-high] specifications in [é] and [u] are in correspondence.
- On the failure of /a/ to raise to [i], see Walker (2005).

(55) Penultimate stress: LICENSE(height)/σ́ >> IDENT-IO(height)

/korderu/	LICENSE (height)/σ́	IDENT(height)	INTEGRITY
☞ a. <korderu, kordéru, kordíru>		*	
b. <korderu, kordéru>	*!		

- [kordíru] represents a form with indirect licensing. INTEGRITY favors a shared autosegment over a duplicated one in adjacent syllables.

Central Venetan

(56) **Strategy for [úrdini]**

- Assimilation in the stressed antepenult, like in Lena, is the first assimilatory step in the chain.

[3] McCarthy (2008) argues that constraints penalizing vowels that are not in the head syllable of some metrical foot are problematic. This is because they are capable of driving vowel deletion in the absence of metrical structure. Drawing on a strategy that McCarthy pursues, the problem could be avoided by imposing a condition on the marked structure requiring that it belong to a metrically-weak position.

- In central Venetan, assimilation in the penult follows, driven by a PROXIMITY constraint. (On proximity applied to assimilation by correspondence, see Rose 2004, Rose & Walker 2004.)

(57) PROXIMITY-σ
Correspondent segments are separated by no more than a syllable.

(58) Ranking of PROXIMITY

- The licensing constraint must dominate PROXIMITY-σ to obtain the chain segment: <… **ó**rdeno, **ú**rdeni, …>; otherwise it would not satisfy harmonic improvement.
- PROXIMITY-σ must dominate IDENT-IO(high) to drive assimilation in the intervening syllable.

(59) LIC([+high]/σ́)>> PROXIMITY-σ >> IDENT-IO(high) >> INTEGRITY-IO

/ordeni/	LIC([+hi]/σ́)	PROX-σ	IDENT(high)	INTEG
a. <ordeni>	*!			
b. <ordeni, **ó**rdeni>	*!			
c. <ordeni, **ó**rdeni, **ú**rdeni>		*!	*	*
☞d.<ordeni, **ó**rdeni, **ú**rdeni, úrd**i**ni>			**	**

- Output candidates (c-d) each present identity licensing.
- (d) yields the desired outcome for /ordeni/.

(60) **Conceptual issues**

- The output in (59d) presents duplicated [+high] in three adjacent syllables. But assimilation between a trigger and adjacent stressed syllable (as in /movi/ → [múvi]), would present a single shared autosegment (cf. (55)). This representational difference does not appear to be empirically supported.
- Alternatively, the step from **ú**rdeni to úrd**i**ni could transition from a duplicated feature in the antepenult to a single shared autosegment across three syllables (assuming INTEGRITY is not a basic faithfulness constraint). This would have the undesirable consequence of employing a Duke of York gambit (Pullum 1976), introducing a duplicated feature only to remove it later in the derivation.

(61) **Problem: Blocking**

- Recall that /a/ blocks harmony: [la(v)ó**r**avi].
- Blocking is driven by top-ranked IDENT-IO(low) (see (40)).
- An erroneous prediction: <lavoravi, lav**ó**ravi, lav**ú**ravi>, with *transparent* /a/, is a well-formed chain in this grammar and predicted to be optimal.
- Ranking paradox: To prevent the chain step <…, lav**ó**ravi, lav**ú**ravi> PROXIMITY-σ must dominate LICENSE([+high]/σ́), but the reverse ranking is needed to obtain assimilation in the antepenult in [úrdini].
- Conclusion: A gradual approach where assimilation in the stressed antepenult precedes assimilation in the penult is not successful.

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