# Gradualness and Harmonic Improvement without Candidate Chains in Chamorro*

Aaron Kaplan
University of Utah
aaron.f.kaplan@gmail.com

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## 1 Chamorro Umlaut

- Certain prefixes/particles (henceforth "prefixes") spread [–back] to root-initial Vs...

(1)

| | | | |
|---|---|---|---|
| gúmɑʔ | 'house' | i gí̱mɑʔ | 'the house' |
| nánɑ | 'mother' | i nɑ̱́nɑ | 'the mother' |
| cúpɑ | 'cigarettes' | i cí̱pɑ | 'the cigarettes' |
| sóŋsuŋ | 'village' | i sé̱ŋsuŋ | 'the village' |

- ...but only if the root-initial vowel is stressed (Chung 1983):

(2)

| | | | |
|---|---|---|---|
| pulónnun | 'trigger fish' | i pulónnun | 'the trigger fish' |
| *i pi̱lónnun, *i pi̱lé̱nnun | | | |
| mundóŋgu | 'cow's stomach' | i mundóŋgu | 'the cow's stomach' |
| *i mi̱ndóŋgu, *i mi̱ndé̱ŋgu | | | |

- Candidate Chains (OT-CC; McCarthy 2007a,b) predicts blocking by unstressed vowels.
- Cf. Central Venetan metaphony, e.g.: [+high] spreads leftward to the stressed syllable through intervening syllables (Walker 2008, to appear):

(3) a. *No intervening syllables*

| | | | |
|---|---|---|---|
| kal-sé-to | 'sock (masc. sg.)' | kal-sí̱-ti | 'sock (masc. pl.)' |
| kant-é-se | 'sing (1 pl.)' | kant-í̱-si-mo | 'sing (1 pl. impf. subj.)' |

b. *An intervening syllable*

| | | | |
|---|---|---|---|
| órdeno | 'order (1sg.)' | úrdi̱ni | 'order (2sg.)' |

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- OT-CC's account of umlaut precludes an analysis of metaphony.
- Despite initial appearances, a classic OT approach is superior because it is compatible with both umlaut and metaphony.
- Classic OT better accounts for phenomena that seem to be evidence for OT-CC's special machinery.

# 2 OT-CC

## 2.1 Umlaut via Gradualness and Harmonic Improvement

- OT-CC: candidates are ordered $n$-tuples ("chains") of forms; first is fully faithful, last is surface form. Two requirements:

▷ **Gradualness:** Only one change at a time; each step adds one violation of a "basic" faithfulness constraint.

(4) Chains for (1) and (2):

a. ✓*<i gúmaʔ, i gı́maʔ>* *(Just one violation of* IDENT*(back))*

b. ***<i pulónnun, i pılénnun>* *(Two violations of* IDENT *in one step)*

c. ✓*<i pulónnun, i pılónnun, i pılénnun>* *(One violation of* IDENT *per step)*

▷ **Harmonic Improvement (HI):** Each non-initial member of the chain must perform better on the constraint ranking than its predecessor.

(5) LICENSE($[-\text{back}]_{\text{prefix}}$, $\acute{\sigma}$): [–back] in a prefix or particle must be associated with a stressed syllable. (Walker 2001, 2005, Zoll 1998a,b)

- *<i gúmaʔ, i gı́maʔ>* (4a) obeys HI:

(6)

| /i gúmaʔ/ | LICENSE($[-\text{back}]_{\text{prefix}}$, $\acute{\sigma}$) | IDENT(back) |
|---|---|---|
| a. i gúmaʔ | *! | |
| ☞ b. i gı́maʔ | | * |

- But *<i pulónnun, i pılónnun, i pılénnun>* (4c) does not:

(7)

| /i pulónnun/ | LICENSE($[-\text{back}]_{\text{prefix}}$, $\acute{\sigma}$) | IDENT(back) |
|---|---|---|
| ☞ a. i pulónnun | * | |
| b. i pılónnun | * | *! |

- Since both chains for /i pulónnun/ → **i pılénnun* are blocked, OT-CC correctly predicts that umlaut will occur only with root-initial stress.

- Classic OT predicts long-distance umlaut under this ranking:

(8)

| /i pulónnun/ | LICENSE([–back]$_{\text{prefix}}$, $\acute{\sigma}$) | IDENT(back) |
|---|---|---|
| (☞) a. i pulónnun | *! | |
| b. i pi̲lónnun | *! | * |
| ☠ c. i pi̲lé̲nnun | | ** |

- OT-CC's restrictive architecture automatically predicts the attested umlaut pattern and seems to have a clear advantage over classic OT.

⇒ However, this advantage is a liability in Central Veneto.

## 2.2 Metaphony in OT-CC

- The OT-CC framework described above cannot produce *ú̲rdi̲ni*:

(9) Possible chains:
a. **<*órdeni*, *ú̲rdi̲ni*> ruled out by gradualness.
b. **<*órdeni*, *órdi̲ni*, *ú̲rdi̲ni*> ruled out by HI.

- Walker (2008, to appear): Modify gradualness to allow multiple violations of one faithfulness constraint if the result improves markedness at one locus.

- Under "relaxed gradualness," [+high] can spread to multiple vowels to eliminate a violation of LICENSE: <*órdeni, ú̲rdi̲ni*> is now gradual.

(10)

| /órdeni/ | LICENSE([+high]$_{\text{post-tonic}}$, $\acute{\sigma}$) | IDENT(high) |
|---|---|---|
| a. órdeni | *! | |
| b. órdi̲ni | *! | * |
| ☞ c. ú̲rdi̲ni | | ** |

- But now <*i pulónnun*, *i pi̲lé̲nnun*> (4b) is a possible chain for Chamorro!

(11)

| /i pulónnun/ | LICENSE([–back]$_{\text{prefix}}$, $\acute{\sigma}$) | IDENT(back) |
|---|---|---|
| (☞) a. i pulónnun | *! | |
| ☠ b. i pi̲lé̲nnun | | ** |

- Relaxed gradualness permits an account of metaphony, but it ruins our analysis of umlaut.

⇒ Treating umlaut as attraction to stress, OT-CC can produce either umlaut or metaphony, but not both.

## 2.3 Alternative Analyses of Metaphony

- Gradient Alignment (McCarthy & Prince 1993): each step brings [+high] closer to the stressed syllable, so (9b) is harmonically improving.
- But only /e, o/ raise; other non-high vowels block metaphony. When the stressed syllable contains /a, ɛ, ɔ/, neither it nor the intervening vowels undergo metaphony:

(12) *Stressed low vowels*

| | | | | |
|---|---|---|---|---|
| a. | ángol-o | 'angle (masc. sg.)' | ángol-i<br>*ángul-i | 'angle (masc. pl.)' |
| b. | áxen-o | 'donkey (masc. sg.)' | áxen-i<br>*áxin-i | 'donkey (masc. pl.)' |
| c. | pɛ́rseg-o | 'peach (fruit) (m. sg.)' | pɛ́rseg-i<br>*pɛ́rsig-i | 'peach (fruit) (masc. pl.)' |

- Alignment would predict **ángul-i*.
- Walker (2008) rules out copying first to the stressed vowel and then to the intervening vowel:

(13) a.

| ú | r | d | e | n | i |
|---|---|---|---|---|---|
| \| | | | | | \| |
| [+hi]$_i$ | | | | | [+hi]$_i$ |

b.

| ú | r | d | i | n | i |
|---|---|---|---|---|---|
| \| | | | \| | | \| |
| [+hi]$_i$ | | | [+hi]$_i$ | | [+hi]$_i$ |

- <*órdeni*, *úrdini*, *úrdini*> is harmonically improving: LICENSE is satisfied in the first step, and constraints on gapped representations, e.g., motivate the second step.
- However, a low intervening vowel blocks metaphony:

(14) *Intervening low vowels*

| | | |
|---|---|---|
| a. | la(v)ór-a-v-a | 'worked, was working (1sg. impf. ind.)' |
| b. | la(v)ór-a-v-i | 'worked, was working (2sg. impf. ind.)' |
| c. | *la(v)úr-a-v-i | |

- Gapped copying would predict **la(v)úr-a-v-i*, which satisfies LICENSE.
- Positional Licensing seems best for metaphony—therefore (something like) relaxed gradualness is necessary.

# 3 Umlaut in Classic OT: Stress as Trigger

- Umlaut occurs when the underlying host of [–back] is (i) in a prefix and (ii) immediately pretonic (henceforth "pretonic").
- Both properties are loci of weakness in Chamorro:
  - Affixes[1] license fewer contrasts than roots (Urbanczyk 2006) and are psycholinguistically weak (e.g. Jarvella & Meijers 1983).
  - Pretonic syllables are weak in Chamorro: Clash is generally tolerated, but pretonic syllables must not be stressed.
- **Worst of the Worst** (Padgett 2002, Smolensky 2006): while prefixes and pretonic syllables are tolerated, positions at which these dimensions of weakness converge are subject to special conditions in that their [–back] features must seek special licensing.
- A new Positional Licensing constraint:

(15) LICENSE([–back]$_{\text{pretonic}}$, Root): [–back] in an immediately pretonic syllable must be associated with the root.

- Stress triggers umlaut—it's not the target.
- Umlaut occurs with root-initial stress:

(16)

| /i gúmaʔ/ | LICENSE([–back]$_{\text{pretonic}}$, Root) | IDENT(back) |
|---|---|---|
| a. i gúmaʔ | *! | |
| ☞ b. i g̱íma ʔ | | * |

- But not otherwise:

(17)

| /i pulónnun/ | LICENSE([–back]$_{\text{pretonic}}$, Root) | IDENT |
|---|---|---|
| ☞ a. i pulónnun | | |
| b. i p̱ilónnun | | *! |
| c. i p̱iḻénnun | | *!* |

- The appearance of gradualness and HI is produced without OT-CC's formalization of these requirements.
- Central Veneto: Walker's (2005) classic OT analysis based on LICENSE([+high]$_{\text{post-tonic}}$, $\acute{\sigma}$) remains viable (see (10)).

⇒ Classic OT can produce both umlaut and metaphony, despite umlaut's weak-vowel blocking.

[1]The particles that trigger umlaut share relevant properties with prefixes. They are function morphemes, and, as clitics, they are not phonologically independent units.

# 4 Pretonic Licensing in OT-CC

- Under relaxed gradualness, OT-CC produces metaphony.
- Why not use LICENSE([–back]$_{\text{pretonic}}$, Root) for umlaut under weak gradualness?
- While this permits accounts of both umlaut and metaphony, OT-CC's special machinery does no work.
  - Long-distance umlaut is blocked not by gradualness and HI, but by the umlaut-inducing constraint.
  - Relaxed gradualness weakens the gradualness requirement so as to allow metaphony.
- At this point, there's reason to use OT-CC.

# 5 Conclusion

- At first glance, Chamorro umlaut seems tailor-made for OT-CC.
- But OT-CC has difficulty producing both umlaut and metaphony.
- This result holds for Harmonic Serialism (Prince & Smolensky 1993[2004]) more generally because HS also has gradualness and HI requirements.
- Reconciling umlaut with classic OT merely requires treating stress as the trigger, not the target.
- Classic OT produces both umlaut and metaphony.
- If classic OT can generate the appearance of gradualness and HI, a major argument for OT-CC is undermined. If other phenomena that seem to require OT-CC's special mechanisms are also amenable to reanalysis, it casts doubt on OT-CC (and HS) as a whole.
- Perhaps OT-CC/HS don't have as many advantages over classic OT as we thought.

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