Unifying Prosodic and Segmental Repair: Metathesis and Epenthesis in Uab Meto

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1 Overview

- Languages differ on what linear orders are contrastive
- In English, all segments are ordered with respect to one another (and thus consonant-vowel orders are contrastive):

(1) **English**

a.	sɑp 'sop'	spɑ 'spa'
b.	ski 'ski'	sik 'seek'
c.	sɑɪt 'sight'	stɑɪ 'sty'
d.	fɹi 'free'	fiɹ 'fear'
e.	ɹion 'reown'	ɹino 'Reno'
f.	pɛɪji 'payee'	pijɛɪ 'PA'

- In Uab Meto (Austronesian; Timor, Indonesia) consonants are only ordered with respect to one another (as are vowels), and so surface order between consonants and vowels optimizes phonotactics and is <u>not</u> contrastive:

(2) **Uab Meto**

a.	mɛop 'work'	ɑ-mɛpo-t 'worker'
b.	ʔoɛl 'younger brother'	ʔolɛ-f 'his younger brother'
c.	sonɑf 'palace'	sonfɑ-m 'palace-and'
d.	mɑun 'chicken (phrase medial)'	mɑnu 'chicken (phrase final)'

- Some linear order changes are predictable from the variants in the phonotactic environment, such as affixation or prosodic position – these are always variants on CV/VC orders
- However, precedence relationships between consonants are unpredictable and need to be stored; the same goes for vowel-vowel precedence relationships

(3) Consonant-Consonant Precedence is Unpredictable

a.	nisi 'tooth'	sini 'filter'
b.	tɑʔɛ 'border'	ʔɑtɛ 'liver'

(4) Vowel-Vowel Precedence is Unpredictable

a.	pɛoʔ 'tell'	poɛʔ 'appear'
b.	niuf 'thousand' (Middelkoop 1963)	nuif 'bone'
c.	mfɑu 'many'	mfuɑ 'you de-kernel (it)'

- **Proposal:** Uab Meto is a language where learners have segmented vowels and consonants onto separate tiers (similar to proposals for Semitic in McCarthy 1986, Rotuman in McCarthy 2000)

(5) Proposed stored form for mɛpo/mɛop 'work':

$$\left\{ \begin{array}{ccc} \text{m} & > & \text{p} \\ \text{ɛ} & > & \text{o} \end{array} \right\}$$

- Consequences for LINEARITY (or another precedence-preserving faithfulness constraint):
  - Forms that preserve this precedence order: mɛpo, mɛop, ɛmpo, ɛmop, ɛomp, and mpɛo
  - Forms that do not preserve this precedence order: pɛmo (*p>m), moɛp (*o>ɛ), ...
- I assume that Uab Meto has undominated LIN constraint – this equates to the generalization that consonants cannot be reordered with respect to one another, nor can vowels
- How this is going to work out:
  - Linear order between consonants and vowels is determined by optimizing for a variety of phonotactic constraints, which we can manipulate by varying the morphological or prosodic context
  - Unlike Semitic (McCarthy 1986), Uab Meto does not allow for infixation, and so certain consonant-vowel orders unambiguously signal morpheme boundaries

2 Words with one vowel

- Word-final consonant clusters are never possible in Uab Meto, but morphemes prefer to end in consonants – in some words, this results in epenthesis
- To capture this, I introduce three constraints, *CC#, C@MORPH, and DEP

(6) *CC#: Assign one violation for each CC cluster that is word-final

(7) C@MORPH: Assign one violation for any morpheme that is not consonant-final
(see FINAL-C McCarthy & Prince 1994; 22)

(8) DEP: Every element in the output has a correspondent in the input. (McCarthy & Prince 1994: 9)

- For a form like [kán-ɑm] 'your name', we have an underlying representation with the non-predictable material: /{k>n, ɑ}-m/

/{k>n, á}-m/	*CC#	C@MORPH	DEP
a. kán-m	*!		
☞ b. kán-ɑm			*
c. knán-m		*!	
d. kán-mɑ		*!	*

- Another generalization: stressed syllables have onsets in Uab Meto
- To capture this, I introduce *NO-ONSET-STR, which penalizes onsetless stressed syllables
  - Note: A constraint like ONSET would not suffice in this situation, because we also have forms like *[ɑtóin], which has two onsetless syllables but prioritizes giving an onset to the stressed vowel and satisfying C@MORPH

(9) *NO-ONSET-STR: Assign one violation for each stressed vowel V́ that doesn't have a consonant directly to its left

- This constraint rules out examples from the previous case like *[ákn-am]

/{k>n, a}-m/	*NO-ONSET-STR	DEP
a. ákn-m	*!	
b. ákn-am	*!	*
☞ c. kán-am		*

3 Words with two vowels

- Uab Meto has a general preference for disyllabic words: empirically, this is observed in epenthesis being blocked in certain configurations
  - For instance [ʔóɛl] 'younger brother' is realized as [ʔólɛ-f] with the suffix *-f* 'his younger brother', even though this violates C@MORPH
- This is represented through MAX-DISYLLABIC constraint (modelled after MAX-BIN in Ito & Mester 2003, Mester 1994)

(10) MAX-DISYLLABIC: In words that have more than two vowels, assign one violation for each additional vowel.

- Consider the form [ólɛ-f] with representation /{ʔ>l, o>ɛ}-f/

/{ʔ>l, o>ɛ}-f/	MAX-DISYLLABIC	C@MORPH	DEP
☞ a. ʔólɛ-f		*	
b. ʔóɛl-af	*!		*

- When we affix multiple consonant-only suffixes, we then get epenthesis again, because changing the order of [óɛl] and [ólɛ] won't repair the *CC# violation
- This correctly predicts that we should get [óɛl-f-am] from /{ʔ>l, o>ɛ}-f-m/

/{ʔ>l, o>ɛ}-f-m/	*CC#	MAX-DISYLLABIC	C@MORPH	DEP
a. ʔóɛl-f-m	*!			
b. ʔólɛ-f-m	*!		*	
c. ʔóɛl-af-m	*!	*		*
☞ d. ʔóɛl-f-am		*		*
e. ʔólɛ-f-am		*	*!	*

- Unlike other languages that have separate tiers for consonants and vowels (such as Arabic), Uab Meto does not have any infixation
- This lack of infixation is represented through *INFIX constraint (opposite of HOMOMORPHEMIC-LINEARITY in Horwood 2004)

(11) *INFIX: If morpheme A > morpheme B, assign a violation for each segment β belonging to morpheme B that precedes a segment α from morpheme A.

- This correctly predicts that *[ólfɛm] is not a licit form of /{ʔ>l, o>ɛ}-f-m/, and instead we get [óɛl-f-ɑm]

/{ʔ>l, o>ɛ}-f-m/	*INFIX	MAX-DISYLLABIC	C@MORPH	DEP
a. ʔól⟨f⟩ɛ-m	*!		*	
☞ b. ʔóɛl-f-ɑm		*		*

- Interim summary:
  - Monosyllabic words generally epenthesize to avoid CC# clusters ([kán-ɑm])
  - Disyllabic words will repair the same *CC# violation by reordering a morpheme-final VC/CV sequence, even if that means violating C@MORPH ([ʔólɛ-f])
  - In cases where reordering consonants and vowels within a morpheme cannot repair the *CC# violation, epenthesis occurs instead ([ʔóɛl-f-ɑm])

4 Words with more than two vowels

- In words with more than two vowels, we see that VV clusters are slightly dispreferred
- To capture this, I introduce a *VV constraint

(12) *VV: Assign a violation for any VV sequence

- Consider the form [ɑ-mépo-t] 'worker' from the root word [méop] 'work' – *VV rules out *[ɑ-mpéo-t]

/ɑ-{m>p, ɛ>o}-t/	*CC#	MAX-DISYLLABIC	C@MORPH	*VV
a. ɑ-méop-t	*!	*		*
☞ b. ɑ-mépo-t		*	*	
c. ɑ-mpéo-t		*	*	*!
d. ɑ-méop-ɑt		**!		*

- If we affix additional vowel-initial suffixes onto [ɑ-mépo-t], we then get [ɑ-méop-t-in] 'workers' because it satisfies C@MORPH without incurring a *CC# violation

/ɑ-{m>p, ɛ>o}-t-in/	*CC#	MAX-DISYLLABIC	C@MORPH	*VV
☞ a. ɑ-méop-t-in		**		*
b. ɑ-mépo-t-in		**	*!	
c. ɑ-mpéo-t-in		**	*!	*
d. ɑ-méop-ɑt-in		***!		*

- This *VV constraint must be ranked low, because words will begin with an onset where possible even if that causes them to violate *VV
- This means that we also have a low-ranked *#V constraint that militates against vowel-initial words

(13) *#V: Assign one violation for each word that begins with a vowel.

- Thus, in words like [boláin] 'peel', with the form /{b>l>n, o>ɑ>i}/, we get [boláin] and not *[obálin]

/{b>l>n, o>ɑ>i }/	*NO-ONSET-STR	C@MORPH	*#V	*VV
a. boálin	*!			*
☞ b. boláin				*
c. obálin			*!	
d. boláni		*!		

- However, in words with two consonants and three vowels, we expect vowel-initial words to still be possible

- For instance, consider the form /{t>n, ɑ>o>i}/ of the word [ɑtóin] 'man'

/{t>n, ɑ>o>i}/	*NO-ONSET-STR	C@MORPH	*#V	*VV
a. tɑnói		*!		*
b. ɑtóni		*!	*	
☞ c. ɑtóin			*	*
d. tɑóin	*!			**

- Note: both *#V and *VV must be dominated by DEP, otherwise we would expect consonant epenthesis in each of these cases

5 Words with one vowel and three consonants

- In words with three consonants and only one vowel, we'd expect a CCVC form

- For instance, consider the word [kfɛt] 'slingshot', with the form /{k>f>t, ɛ}/ – from this, we'd expect [kfét] and not *[kftɛ́] or *[kɛ́ft]

/{f>k>t, ɛ}/	*CC#	C@MORPH	DEP
a. kɛ́ft	*!		
☞ b. kfɛ́t			
c. kftɛ́		*!	
d. káfɛt			*!

- If the first two consonants cannot form an onset cluster, such as *ʔl* in [ʔulɑn] 'rain', epenthesis occurs instead

/{ʔ>l>n, u}/	*CC#	*#ʔL	C@MORPH	DEP
a. ʔúln	*!			
☞ b. ʔúlɑn				*
c. ʔúlnɑ			*!	
d. ʔlún		*!		

- A note on stress: Uab Meto stress is uniformly assigned to the penultimate vowel of the root, and so I assume epenthesized vowels cannot be stressed

(14) *STRESS-EPEN: Assign a violation for an epenthesized vowel that receives stress.

/{ʔ>l>n, u}/	*STRESS-EPEN	*#ʔL	DEP
☞ a. ʔúlan			*
b. ʔálun	*!		*

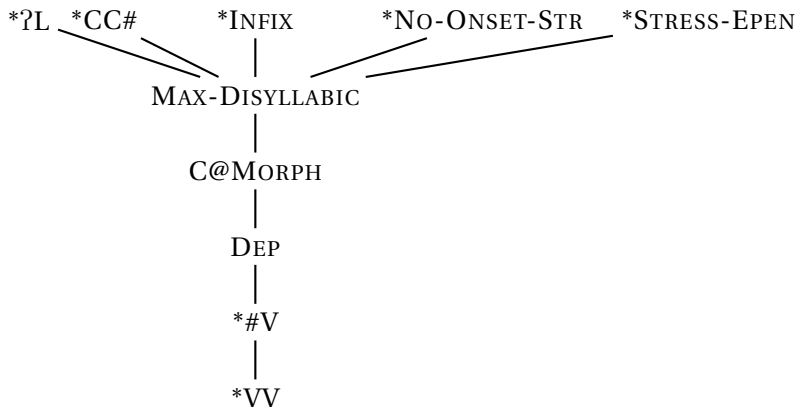
- If we affix a vowel-initial suffix, the epenthesized vowel is not needed, as in [ʔúln-ɛ] 'the rain'

/{ʔ>l>n, u}-ɛ/	*CC#	*#ʔL	*INFIX	MAX-DISYLLABIC	C@MORPH	DEP
a. ʔúlan-ɛ				*!		*
☞ b. ʔúln-ɛ						
c. ʔúl⟨ɛ⟩n			*!			
d. ʔlún-ɛ		*!				

- Note, this isn't likely to be apocope because it doesn't occur very generally: [kfét] 'slingshot'/[kfét-ɛ] 'the slingshot', [máun] 'chicken'/[máun-ɛ] 'the chicken', [atóin] 'man'/[atóin-ɛ] 'the man'

5.1 Interim summary: Monomorphemic forms

- To sum up, we've seen the following constraint ranking thus far:



- In **monomorphemic** forms, this predicts the following:

	V́	V́V	VV́V
C	CV́	CV́V	VCV́V
	há 'four'	háu 'wood'	–
CC	CV́C	CV́VC	VCV́VC
	kán 'name'	méop 'work'	atóin 'man'
CCC	CCV́C	CV́CVC	CVCV́VC
	kfét 'slingshot'	nésɛn 'middle'	boláin 'peel'
*[CC]C	CV́CAC	CV́CVC	CVCV́VC
	ʔúlan 'rain'	ʔáluk 'bag'	–
CCCC	CCV́CAC	CCV́CVC	CVCV́CVC
	plénat 'command'	kníno? 'clean, pure'	bonátin 'fall flat'

6 Discussion and Predictions

- Two advantages of this proposal:
  - Certain consonant-vowel sequences unambiguously signal morpheme boundaries (Trubetskoy 1969: 273-297)
  - "Larger-scale" phonotactics (i.e. sentence prosody) also cause alternations in surface consonant-vowel orders

6.1 Certain sequences signal morpheme boundaries

- Certain linear orders between consonants and vowels signal to speakers that there must be a morpheme boundary
- One example of this is the word [biʄ́ɛ] 'buffalo' (CVCV́V)
- If it were monomorphemic, our model would incorrectly predict *[ibáɛʄ] (VCV́VC) as the surface form
- This surface form is only compatible with a bimorphemic analysis [biʄ-áe] (CVC-V́V)

/{b>ʄ, i}-{ɑ>ɛ}/	*NO-ONSET-STR	*INFIX	C@MORPH	*#V
☞ a. biʄ-áɛ			*	
b. ib-áɛ⟨ʄ⟩		*!		*
c. ib-á⟨ʄ⟩ɛ		*!	*	*

- Recall, we also have a constraint *#V that militates against vowel-initial words
- This correctly predicts that we should see [biʄáɛ] and not *[ibʄáɛ]

/{b>ʄ, i}-{ɑ>ɛ}/	C@MORPH	*#V
a. ibʄ-áɛ	*	*!
☞ b. biʄ-áɛ	*	

- While inserting this morpheme boundary may seem stipulative, looking further into it shows that *bi(ʄ)-* is seen as a prefix for a variety of hooved mammals:

(15) a. *biblus* 'deer'
b. *bibi* 'goat'
c. *bikase* 'horse'
d. *bibdomba* 'sheep'
e. *bikaeslukemnanu* 'mule' (Manhitu 2007)

6.2 Prosodically-triggered alternations

- Might expect that other things could trigger metathesis on the sentential level, and they do!
- **Prosodic marking**: Certain syntactic/prosodic boundaries coincide with a [+SONORANT]: vowels>l, β, and ʄ

(16) Prosodic marking in the verbal domain

a. *auʔ ʔ-**aim** bikase ʔi*]$_{PrEdge}$
1SG 1.AGR-look.for horse DEM
I look for the horse.

b. *bikase ʔi, auʔ ʔ-**ami***]$_{PrEdge}$
DEM horse, 1SG 1.AGR-look.for
The horse, I look for (it).

(17) Prosodic marking in the nominal domain

a. ***máun** fúʄ͡ʄ*]$_{PrEdge}$
chicken wild
'wild chicken'

b. ***mánu***]$_{PrEdge}$
chicken
'chicken'

(18) SON@PREDGE: Assign one violation for a non-sonorant that coincides with a prosodic edge.

- Consider the word 'chicken' /{m>n, ɑ>u when it appears at a prosodic/syntactic edge → [mánu] 'chicken', as in (18b.)

/{m>n, ɑ>u-]$_{PrEdge}$/	SON@PREDGE	C@MORPH	*VV
a. máun	*!		*
☞ b. mánu		*	
c. mnáu		*	*!

- In contrast, if the same word is embedded within a larger nominal constituent, we get [máun-fuʄ͡ʄ] 'wild chicken', as in (18a.)

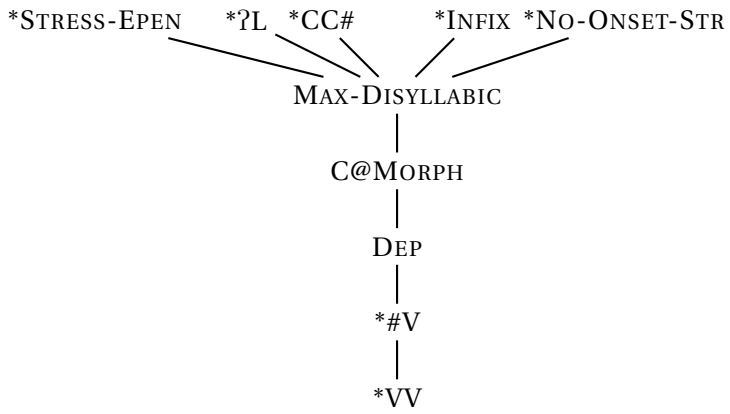
/{m>n, ɑ>u-{f>ʄ͡ʄ, u}-]$_{PrEdge}$/	SON@PREDGE	C@MORPH	*VV
a. mánu-fuʄ͡ʄ		*!	
☞ b. máun-fuʄ͡ʄ			*
c. mnáu-fuʄ͡ʄ		*!	*

6.3 Comparison with Rotuman

- The Uab Meto pattern superficially resembles the well-known case of **Rotuman** (McCarthy 2000, Besnier 1987, Takahashi 2018) where metathesis is primarily conditioned by syntactic context
- But Uab Meto is not just a copy of the Rotuman pattern: Uab Meto metathesis is based in phonotactic conditioning, where alternations in consonant-vowel orders occur in complementary distribution with epenthesis
- Rule-based approaches to Uab Meto metathesis (Steinhauer 1993, 1996, Edwards 2016, 2018) beg the question: why is metathesis the favored operation for both phonotactic repair and prosodic marking?
  - This approach has a response: metathesis comes for free in the language, because consonants and vowels fall onto separate tiers
  - Thus, consonant-vowel metathesis (and not epenthesis) is expected to be the preferred general strategy for optimizing phonotactic and prosodic well-formedness

7 Conclusion

- In Uab Meto, surface linear order is not contrastive; rather only orders between consonants and other consonants or vowels and other vowels are
- This surfaces in how Uab Meto can rearrange the consonants and vowels within morphemes to optimize (quite ordinary) phonotactic preferences:
  - Stressed vowels have onsets
  - No word-final CC clusters
  - Words are disyllabic (or shorter) when possible
  - Morphemes end in a consonant
  - Limit epenthesis



- This project suggests that the set of languages with tier-based representations may be larger than first assumed
  - Uab Meto does not have template-morphology, and yet it shares separating consonants and vowels onto separate tiers with languages like Arabic (McCarthy 1986)
  - Nor does Uab Meto have long-distance harmony effects, and yet variations in surface linear order are enough for learners to segment consonants and vowels onto separate tiers

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8 Appendix 1: Prosodic Marking

- Uab Meto has both phonologically and prosodic/syntactically conditioned metathesis
- A previously-described example of the syntactically-conditioned type is **Rotuman**, spoken in Fiji (Besnier 1987, McCarthy 2000, Churchward 1967)
  - Rotuman: 'complete' and 'incomplete' phases – several operations, which range from metathesis (CVCV → CVVC) to deletion (CVCV → CVC) and umlauting (CVCi → CV[+HIGH]C)
- In contrast, Uab Meto (descriptively) has the following:
  - **Metathesis**: Occurs in non-monosyllables with penultimate stress …VC ↔ …CV
    *ma**un*** 'chicken (phrase-medial)' // *ma**nu*** 'chicken (phrase-final)'
  - ***a*-Epenthesis**: Occurs elsewhere (i.e. consonant-final, stress-final words & CCC clusters)
    nim 'five (phrase-medial)' // *nim**a***ʔ 'five (phrase-final)'
  - **Consonant Insertion**/Deletion: Occurs at right morpheme edges of vowel-final morphemes
    bi͡ʃʒáe 'buffalo (phrase-medial)' // *bi͡ʃʒáe**l*** 'buffalo (phrase-final)'

- Syntactic generalization: if a noun's right edge coincides with an nP edge, or a verb's with a vP edge, the SON@PREDGE constraint applies, meaning that you see either VC/CV metathesis, vowel epenthesis + a glottal stop, or consonant insertion
- Sometimes the prosodic edge is realized as a consonant: like ʔ in [nimɑʔ] 'five' (23) (independently proposed for Austronesian in Blevins 2008)

(19) Noun + Adjective

a. *ma**un*** *mutiʔ*]$_{PrEdge}$
chicken white
'white chicken'

b. *ma**nu***]$_{PrEdge}$ *mutiʔ*
chicken white
'The chicken is white'

(20) Verb + Direct Object

a. *bikase ʔi,* *auʔ* ***ami***]$_{PrEdge}$
DEM horse, 1SG look.for
The horse, I look for (it).

b. *auʔ* ***aim*** *bikase ʔi*]$_{PrEdge}$
1SG look.for horse DEM
I look for the horse.

(21) Noun + Noun Compounding

a. *at**ói**n* *k**á**se*]$_{PrEdge}$
man city
'city man'

b. *at**ó**ni*]$_{PrEdge}$
man
'man'

(22) Noun + Numeral

a. *ne**on*** *nim**a**ʔ*]$_{PrEdge}$
day five
'day five/Friday'

b. *ne**no***]$_{PrEdge}$ *nim*
day five
'five days'

- Metathesis is blocked where it would lead to a *CCC cluster within a prosodic domain

(23) a. [*fa**ut*** *mutiʔ*]$_{\text{PrEdge}}$] 'white stone' [*fa**tu*** *klima*]]$_{\text{PrEdge}}$ 'spark stone' *[*faut klima*]

b. [*ba**el*** *feʔu*]$_{\text{PrEdge}}$]] 'new place' [*ba**le*** *mnatuʔ*]$_{\text{PrEdge}}$] 'place of gold' *[*bael mnatuʔ*]

9 Appendix 2: Consonant Insertion

- Consonant Insertion (voiced consonant/∅ alternation) occurs when vowel-initial suffixes are placed on a vowel-final stem
- This is because Uab Meto does not permit two vowels to be separated only by a morpheme boundary (*V-V)

(24) Nominal Specificity Suffix *-e*

a. [*nu*] 'two' [*nu*β*-e*] 'the two' (Middelkoop 1963)

b. [*meo*] 'cat' [*meo*β*-e*] 'the cat' (Middelkoop 1963)

c. [*bi*ʃʒ*ae*] 'buffalo' [*bi*ʃʒ***l****ae**l**-e*] 'the buffalo'

d. [*fé*] 'woman' [*fé**l**-e*] 'the woman'

e. [*fai*] 'night' [*fa*ʃʒ*-e*] 'the night' (Middelkoop 1963)

f. [ʔ*ii*] 'this' [ʔ*i*ʃʒ*-e*] 'this (particular) one'

- The inserted consonant is highly predictable from the final vowel: u and o → β, i → ʃʒ, and ɛ → l
- One wrinkle is that SON@PREDGE should allow vowel-final words to occur at prosodic/syntactic edges, and yet consonant insertion occurs in these cases

(25) a. [*fái*] ‘night (phrase-medial)’ [*fáʄ͡ʝ*] ‘night (phrase-final)’
b. [*núa*] ‘two (phrase-medial)’ [*núβ*] ‘two (phrase-final)’

- Descriptively, we can say that the set of voiced segments β, ʄ͡ʝ, and l are preferred at these edges, but that vowels will also suffice in certain situations – integrating consonant insertion into this analysis is left for future work