LENITION AND FORTITION IN AUSTRALIAN LANGUAGES: THE CASE OF YOLNGU AND WUBUY*

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1. INTRODUCTION

- Continuant-stop alternations are prevalent in many Australian languages. Some have hitherto been analysed as lenition (eg. Gaalpu: Wood 1978) whereas others have been analysed as segmental hardening (eg. Nunggubuyu a.k.a. Wubuy: Heath 1984)
- In this paper, I discuss two alternation patterns: lenition in Yolngu, and hardening in Wubuy.
- I propose a phonological analysis couched in Optimality Theory (OT; Prince & Smolensky 2004[1993]) and argue that the alternation patterns in ***both*** Yolngu and Wubuy can be accounted for by the same constraint hierarchy.
- I also discuss some residual issues that should be investigated namely variation, and the analysis of the glottal stop.

2. LENITION IN YOLNGU

- The main focus of this paper is on the continuant-stop alternation patterns in three varieties of Yolngu: Djapu (Morphy 1983), Gaalpu (Wood 1978) and Djambarrpuyngu (Heath 1980; Wilkinson 1991).
- These are often classified as Eastern varieties of Yolngu.
- Yolngu is suffixing, so the only targets are suffix-initial segments.
- The following examples show the alternation in Djapu and Gaalpu:

Some examples from Djapu

(1)	wa:jin-ku	→	wa:jin**k**u	'animal- DAT'
(2)	bumbaru-ku	→	bumbaru**w**(u)	'rock- DAT'
(3)	garapa-ṯu	→	garapa**j**(u)	'spear type-INSTR'
(4)	yu:lŋu-ṯu	→	yu:lŋu**j**(u)	'people-ERG'

Some examples from Gaalpu

(5)	mu:ŋuk-puj	→	mu:ŋuk**p**uj	'Salt water-ASSOC'
(6)	kaŋa-puj	→	kaŋa**w**uj	'spear- ASSOC'

* Acknowledgements: I would like to thank Brett Baker for his insightful comments on numerous drafts of this paper. All remaining faults are my own. I would also like to thank Felicity Meakins and Myf Turpin for organising ALW 2011 and giving me the opportunity to present this paper.

(7) pu:ɻum-ku → pu:ɻumku 'fruit- DAT'
(8) t̪akaj-ku → t̪akajwu 'the top- DAT'

	bilabial	lamino-dental	apico-alveolar	apico-retroflex	lamino-palatal	dorsal
fortis stop	p	t̪	t	ʈ	c	k
lenis stop			(d)[1]	ɖ		
nasal	m	n̪	n	ɳ	ɲ	ŋ
laterals			l	ɭ		
rhotics			r	ɻ		
semivowel	w				j	(w)

Table 1. Phoneme inventory of Yolngu

2.1 Stop contrast

- Possible phonemic fortis/lenis contrast
- A number of solutions have been proposed to account for this: i) segmental, ii) geminate, iii) prosodic.
- Butcher (1995): phonetic investigations into correlates of this contrast in Gupapuyngu and Djapu.
- He found that fortis stops in Gupapuyngu were on average three times as long as lenis stops and that voicing into closure was curtailed.

2.2 Lenition and conditioning environments

- Wood (1978), Morphy (1983) and Wilkinson (1991) describe an alternation between peripheral and laminal stops and semivowels, but not apicals.

[+cont]		[-cont]
A		B
w	↔	p
j	↔	t̪
j	↔	c
w	↔	k

Table 2. Continuant-stop correspondences

[1] Wood (1978) suggests that there is not sufficient evidence to maintain a contrast between [t] and [d], and gives just one onomatopoeic example of [d], in [kuɻudut] 'bird: species of dove'. The status of this contrast, however, is not relevant to the main focus of this paper.

- Suffixes surface with an initial stop following root-final stops and nasals, and with continuants following root-final non-nasal sonorants and vowels
- Crucially, this alternation only occurs at the morpheme boundary.
- The rule can be described in SPE terms as:

(9) $[\text{-son}] \rightarrow [\text{+cont}] \,/\, [\text{+cont}]+\_\_\_[\text{+cont}]$

- So a nonsonorant stop becomes a continuant (semivowel) when flanked by two continuant segments.
- In Djambarrpuyngu, both Heath (1980) and Wilkinson suggest that there is a tendency for the lenited form to appear following "longish stems" (Heath 1980: 9)

ERG/INSTR	-ṯu~-ju
DATive	-ku~-wu
ORiginative	-kuŋu~-wuŋu
OBLique	-kal~-wal
OBLiqueStem	-kalaŋu~-walaŋu
PERlative	-kur~-wur
ASSOCiative	-puj~-wuj

Table 3. Some alternating suffixes in Yolngu

- The role of the following vowel in conditioning lenition
  - Morphy (1983) does not describe the role of the following vowel in conditioning lenition
  - Wood (1978) suggests that the following environment, that is the vowel, is crucial
  - The role of the vowel cannot be tested synchronically since suffixes obey the basic syllable structure of Yolngu which is CV(C)(C)[2]. This means that segmental target of lenition must necessarily be followed by a vowel.
  - Moreover, historically word-internal lenis stops lenited to their corresponding continuant in *intercontinuant position*, that is *both the preceding and following* segments were necessary.
  - Evidence of the sound change can be seen by comparing cognates in Gupapuyngu:

[2] A vowel deletion rule applies to word-final vowels that are preceded by only one consonant.

	Gupapuyngu[3]	*Gaalpu*	
(10)	ɻaɟal	ɻajal	'clean sand'
(11)	carbaɻbaɻ	carwaɻwaɻ	'long and thin'

	Gupapuyngu	*Djapu*	
(12)	ɭirgi	ɭirwi	'charcoal'
(13)	gaɟak	gajak	'subsection term'

3. HARDENING IN WUBUY

- Wubuy (a.k.a. Nunggubuyu) is a prefixing language belonging to the Gunwinyguan family, just south of the Yolngu family group.
- Heath (1984) describes a process of continuant-hardening in morpheme-initial position.
- Wubuy is prefixing, therefore both root-initial and suffix-initial segments undergo this alternation.
- Examples:

Alternations in suffixes

(14)	maṯalak-ruc	→	maṯalatuc[4]	'at the beach'
(15)	a-l̪aaŋ-tuc	→	al̪aaŋtuc	'on the chin'
(16)	a-l̪akuɭa-ruc	→	al̪akuɭaruc	'on the lip'

Alternations in stems

(17)	ŋa-w_2aŋ	→	ŋaw_2aŋ	'I bit it (NEUT class)'
(18)	nun-w_2aŋ	→	nunpaŋ	'you bit it (NEUT class thing)'
(19)	ŋa-$w_2$ini	→	ŋa$w_2$ini	'I hit it'
(20)	ŋam-$w_2$ini	→	ŋampini	'I would have hit it'

[3] The lenis/fortis contrast is maintained in Gupapuyngu. Thus I have represented this contrast using both the voiced (lenis) and voiceless (fortis) stop symbols where necessary.

[4] There is a /k/ deletion rule that deletes the stem-final /k/. Though as Baker (2009) points out this process does not seem to be a hard and fast rule and there is variation in the output.

	bilabial	lamino-dental	apico-alveolar	apico-retroflex	lamino-palatal	dorsal
stop	p	t̪	t	ʈ	c	k
nasal	m	n̪	n	ɳ	ɲ	ŋ
laterals		l̪	l	ɭ		
tap			ɾ			
semivowel	w			ɻ	j	(w)

Table 4. Phoneme inventory of Wubuy (Following Baker 2009)

- Heath describes an alternation between stops and continuants morpheme initially at all places of articulation. Note, however, that the apical laterals /l/ and /ɭ/ do not alternate.

[+cont] A		[-cont] B
w_2	↔	p
l̪	↔	t̪
r	↔	t
ɻ	↔	ʈ
j	↔	c
w_1	↔	k

Table 5. Wubuy consonant alternations, following Heath 1984

- The underlying segment is posited to be the continuant and the surface stop realisations are derived from a rule hardening continuants following morpheme-final stops and nasals.
- The hardening rule can be stated as follows:

(21) [+cont] → [-cont] / [-cont]+___ (modified from Heath 1984: 62)

- So a semivowel or liquid (a continuant) becomes a stop (a noncontinuant) following a morpheme-final stop or nasal (non-continuant segments).

4. Proposed OT analysis

4.1 The constraints

- Kingston (2008) proposes a phonetically motivated constraint – he argues that lenition occurs to "reduce the extent to which a consonant interrupts the stream of speech" (p. 1).
- Modifying this constraint, I propose the following "lenition-causing" constraint:

(22) SonPres: Assign one violation mark for every segment with the feature [-sonorant] that falls in between two sonorants, essentially : *[-son]/[+son]_[+son]. [Prohibits nonsonorants from falling in between two sonorant segments]

- Recall that lenition does not occur after nasals, even though nasal segments are specified as [+son]. To capture this fact, I propose the following constraint, following from Syllable Contact Law (Murray and Vennemann 1983):

(23) SCL: For a heterosyllabic sequence of *A*$*B*, where *b* is the consonantal strength of *B* and *a* is the consonantal strength for *A*, assign one violation mark for every segment, *B*, whose consonantal strength is lower than that of A (ie. $*b < a$) where the values of *a* and *b* are either *W* or *S* (where $S > W$).

- SCL in (23) specifically refers to a strength hierarchy of segments that can best be exemplified in figure 1.

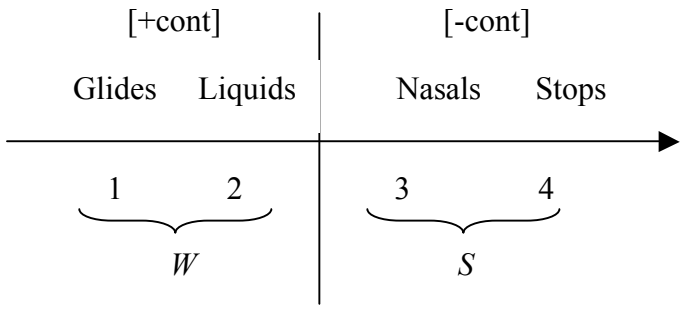

Figure 1. Consonant strength scale in Yolngu

- SCL penalises stops that lenite to continuants following a nasal (or stop). So sequences of *WS* (such as liquid-stop) are allowed but the reverse (*SW*: such as stop-glide) is prohibited.

- SCL is a well-established cross-linguistic tendency (eg. Korean: Davis & Shin 1999) and is apparently exception-less in the Yolngu and Wubuy lexicons.
- The markedness constraints are ranked against these faithfulness constraints – these constraints limit the alternation:

(24) IDENT[SON]: Assign one violation mark for every change in the value of the feature [sonorant] between the input and the output. [Prohibits any change to the specification of the feature [sonorant]]

(25) IDENT-STEM: Assign one violation mark for every change in the value of any feature in the *stem* between the input and the output. [This is needed to ensure that stem-internal intercontinuant stops do not lenite]

(26) MAX: Assign one violation mark for every segment that is deleted between input and output. [Prohibits deletion]

(27) DEP-C: Assign one violation mark for every consonant segment that is inserted between input and output. [Prohibits insertion]

- The ranking of must be above SONPRES. The reason why I have ranked IDENT-STEM under SCL will be discussed with reference to Wubuy below.

(28) Constraint ranking:
MAX, DEP-C ≫ SCL ≫ IDENT-STEM ≫ SONPRES ≫ IDENT[SON]

(29) Summary Tableau

	takaj-ku the top-DAT	MAX	DEP-C	SCL	IDENT-STEM	SONPRES	IDENT[SON]
☛a.	takajwu					*	*
b.	takajku					**!	
c.	takaju	*!				*	
d.	takaj*t*ku		*!			*	
e.	tawajwu				*!		**
f.	tawajpu				*!	*	*

4.2 Accounting for segmental hardening

- The constraint hierarchy presented above is capable of explaining the hardening pattern in Wubuy as well as the lenition one in Yolngu, this is despite the differences in the way these processes are described.
- This falls out directly from the following observation in Table 6.:

Environments	Wubuy **Allative-Dative: -w$_1$uj**	Yolngu **Associative: -puj**	
Following semivowels, liquids and vowels	*UR:* *-w$_1$uj*	*Lenited:* *-wuj*	Continuant-variant: SONPRES
Following stops, nasals	Hardened: -kuj	UR: -puj	*Stop-variant: SCL*

Table 6. Correspondences between Wubuy and Yolngu

(30) Hardening of underlying continuant following stem-final stop

	a-l̪aaɲ-ruc ‘on the chin’	SCL	SONPRES	IDENT[SON]
☛a.	a l̪aaɲtuc		*	*
b.	a l̪aaɲruc	*!		

(31) No hardening following a vowel

	a-l̪akuɭa-ruc ‘on the lip’	SCL	SONPRES	IDENT[SON]
☛a.	a l̪akuɭaruc		*	
b.	a l̪akuɭatuc		**!	*

- There are some stop-initial stems that never show alternations in the relevant contexts. We have already seen the need for the IDENT-STEM. In Wubuy, IDENT-STEM ensures that stop-initial stems do not alternate. The ranking of IDENT-STEM needs to be below SCL, since if not we would not see any alternations at all of continuant-initial stems.

(32) IDENT-AFFIX: Assign one violation mark for every change in the value of any feature in the *affix* between the input and the output.

- IDENT-AFFIX would have to be below our lenition causing constraint SONPRES.

(33) Partial hierarchy
… SCL ≫ IDENT-STEM ≫ SONPRES ≫ IDENT[SON], IDENT-AFFIX

(34) Non-leniting stop-initial stem

	ŋa-**c**ura 'I push'	SCL	IDENT-STEM	SONPRES	IDENT[SON]
☛a.	ŋa**c**ura			*	
b.	ŋa**j**ura		*!		*

(35) Stem-initial hardening

	ŋam-**w**$_2$ini 'I would have hit it'	SCL	IDENT-STEM	SONPRES	IDENT[SON]
☛a.	ŋam**p**ini		*	*	*
b.	ŋam**w**ini	*!			

- The phonotactics of complex words in Wubuy (and Yolngu) conforms to that of the lexicon as a whole.

5. SOME RESIDUAL PROBLEMS

5.1 THE GLOTTAL STOP

- The behaviour of the glottal stop is problematic for any analysis of Yolngu's alternation patterns.
- It has a restricted distribution: it occurs only in syllable-final position following a sonorant. Words can contain a maximum of one glottal stop.
- Segmental vs. Prosodic analysis
  - Prosodic analysis: fortis syllables contain glottal stops.
- But glottal stops are at least phonemically contrastive:

(36) palaʔ 'house, building'
(37) pala 'direction away'

(38) kuḻkuʔ 'fish'
(39) kuḻku 'many, lots'

- Syllable-final glottal stops do not affect the stop-continuant alternations in any way – the conditioning factor is the segment before the glottal stop.

(40) palaʔ + ku → palaʔwu 'house-DAT'

(41) kuɭkuʔ + ku → kuɭkuʔwu 'fish- DAT'

From Djambarrpuyngu

(42) warakanʔ + ku → warakanʔku 'animal- DAT'

- Any specification for the features [sonorant] and [continuant] for the glottal stop would prove problematic for an analysis. Briefly, whatever specification we have for these features would make the wrong predictions. Eg. If the glottal stop is [-cont], then SCL ensures that suffixes will always harden. Yet, even if we only specify the glottal stop for [son], either value +/- would predict that lenition would either *always* or *never* occur. (see Appendix for illustrations of this problem)
- A possible representation of the glottal stop – glottal stop as phonation type specified solely for the monovalent feature [creak]:

(43) Glottal stop

Root Node: [ ]
|
Place Node: [ ]
|
Laryngeal node [creak]

(Following Baker 2008, 57)

- This is only a tentative proposal; more phonetic investigations need to be conducted.

5.2 Variation

- In Wubuy, the alternations are categorical (see Heath 1984). In Yolngu, however, sonority preservation is variable.
- In both Djambarrpuyngu and Djapu, there is a degree of variation in the realisation of the suffix following liquids, semivowels and vowels; that is, in the environments in which we would expect lenition to occur.
- But crucially, in both varieties, the stop-variant of the suffix categorically surfaces following stops and nasals – so SCL is exceptionless.
- Djambarrpuyngu: Heath (1980) and Wilkinson (1991)
    - Wilkinson (1991): "Intervocalic suffix-initial stops are voiceless and relatively long." Presumably this refers to the instances seen in Table 7 below (reproduced from Wilkinson 1991).

Suffix	Following stops, nasals	Following semivowels and liquids	Following vowels
Associative	-puj	-puj/-wuj	-wuj/-puj
Oblique	-kal	-wal/-kal	-wal
Perlative	-kur	-kur/-wur	-kur/-wur

Table 7. Some suffixes with variable realisations following Wilkinson (1991)

  - Heath (1980) suggests that there is a fortis/lenis contrast in suffix-initial segments in Djambarrpuyngu. He claims that this contrast is neutralised following stops and nasals.
  - He also notes an irregular second process that *optionally* lenites the fortis stop to a corresponding semivowel following continuants suffix-initially. This results in a three-way alternation: -puj~-buj~-wuj
  - So following continuants, suffixes are realised either as /-puj/ or /-wuj/.
- Djapu: Morphy (1983) suggests that there is a similar degree of variation.
  - She argues that the variation is due to the fact that the system is in transition.
  - Formerly fortis stop-initial suffixes neutralise following stops and nasals.
  - These morpheme-initial segments are then reinterpreted, by analogy, as behaving regularly like other alternating suffixes. So we see lenition occurring following stem-final continuants.
- Eg. Associative /–puj/. (In Ritharrngu, where the stop contrast is maintained, this is a fortis-stop initial suffix)

(44) Neutralisation
/-puj/ → [-buj] / [-cont] + __

(45) By analogy, the stop is lenited following stem-final continuants (this regularises the system of alternations)
/-puj/ → [-wuj] / [+ cont] + __

- These kinds of patterns pose difficulties for any synchronic analysis.

6. CONCLUSION

- Despite differences in directionality, the alternation patterns in Yolngu and Wubuy can be accounted for by the same constraint hierarchy.
- Stop-continuant alternations in the languages discussed in this paper are conditioned by constraints: SCL and SONPRES.
- SCL is a high-ranked phonotactic constraint and is seemingly unviolated in the lexicon.
- SONPRES, however, seems to be variable in Yolngu.
- Variation is as a result of the system moving from one with a stop contrast to one without this contrast.
- More fieldwork needs to be done to ascertain the state of the present phonological system (ie. does variation still exist?) – and also to figure out the phonetic manifestation of the glottal stop!
- Morphological conditioning factors – long stems and the preference for the lenited variant of the suffix.

APPENDIX:

(46) Glottal stop with specification [+son, -cont] (Unattested optimal candidate indicated with ☠): Lenition is always blocked.

	/palaʔ + puj/	SCL	*[-SON]/[+SON] + _[+SON]	IDENT[SON]
☛a.	palaʔwuj	*!		*
☠b.	palaʔpuj		*	

(47) Glottal stop with specification [+son, +cont] (Unattested optimal candidate indicated with ☠): Lenition is always triggered.

	/jawariŋʔ + ku/ 'adolescent men- DAT'	SCL	*[-SON]/[+SON] + _[+SON]	IDENT[SON]
☛a.	jawariŋʔku		*!	
☠b.	jawariŋʔwu			*

(48) Glottal stop with specification [-son, +cont] (Unattested optimal candidate indicated with ☠): Lenition is never triggered.

	/palaʔ + puj/	SCL	*[-SON]/[+SON] + _[+SON]	IDENT[SON]
☛a.	palaʔwuj			*!
☠b.	palaʔpuj			

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