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DEPARTMENT OF LINGUISTICS AND APPLIED LINGUISTICS

Continuant-stop alternations in  
Australian languages:  
A look at Yolngu and Wubuy

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This thesis is submitted in partial fulfilment of the requirements of the Degree of Bachelor of Arts (Honours) in the Department of Linguistics and Applied Linguistics of the University of Melbourne. Work presented herein is the original work of the author, unless otherwise acknowledged.

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June 2011

# TABLE OF CONTENTS

<i>Acknowledgements</i> .....	iv
<i>List of figures and tables</i> .....	v
<i>Abbreviations</i> .....	vi
Chapter 1. Introduction .....	1
1.1 Lenition: a working definition .....	2
1.2 Alternation patterns in Australian Aboriginal languages.....	3
1.3 Theoretical framework: Optimality Theory .....	5
1.4 Structure of thesis.....	7
Chapter 2. Yolngu Matha.....	8
2.1 Continuant-stop alternations .....	8
2.2 Yolngu Matha: An overview .....	10
2.3 Phoneme inventory.....	13
2.3.1 The nature of the stop contrast.....	14
2.4 A note about environments.....	15
2.5 Other non-phonological conditioning factors.....	17
Chapter 3. Lenition: A formal analysis .....	18
3.1 Lenition as an increase in intensity.....	18
3.2 Lenition in Yolngu .....	19
3.3 The nasal question.....	22
3.4 The status of the apical series.....	26
3.5 Previous analyses of lenition .....	28
3.5.1 Lenition in Autosegmental Phonology .....	28
3.5.2 OT accounts: Against local Agree.....	29
3.6 Continuant vs. Sonorant .....	30
3.6.1 The nasal suffix problem.....	31
3.7 The glottal stop.....	32
3.7.1 Analysing the glottal stop .....	34
Chapter 4. Segmental hardening in Wubuy .....	39
4.1 Hardening in Wubuy .....	39
4.2 Application of the constraint hierarchy.....	41

Chapter 5.	Residual issues.....	45
5.1	Variation in suffix realisation .....	45
5.1.1	Problems with an implicational hierarchy .....	48
5.2	Final vowel deletion and opacity .....	49
Chapter 6.	Conclusion.....	52
6.1	Continuant-stop alternations: Lenition and hardening.....	52
6.2	Future directions and concluding comments.....	52
<i>References</i>	.....	54

## *Acknowledgements*

First and foremost, I'd like to express my deepest appreciation to Brett Baker who agreed to take on the role of supervisor even before arriving at the university. Brett was always encouraging and patient with the numerous drafts of this thesis. His advice with regards to this thesis and also to my applications to PhD programs in the United States was very much appreciated. I will always be grateful for his candour and insight.

I am also very grateful to the department for the support that it has provided both during my undergraduate and honours years. I would particularly like to thank Rachel Nordlinger, Janet Fletcher, Barb Kelly, and Jean Mulder (in no particular order) who taught me over the honours year and made it such a rewarding experience. Thanks also to all those who gave me feedback at the department poster presentation and at the Australian Languages Workshop on Stradbroke Island in March.

I would also like to mention all the friends and classmates who have made the last year (and the years before that) such a wonderful experience. Particular thanks goes to all the students from the honours cohort of 2011 (and 2010) and other PhD students for their sympathy and support over numerous post-LFG coffees, Issues morning teas and Phonetics Lab discussions. Just as importantly, I greatly appreciate the opportunity of staying at Janet Clarke Hall, my home for the last four years. I would particularly like to thank Dr. Powell and Mrs. Davies, other staff and students of the college, too many to list, for their support and encouragement.

This thesis would not have been possible had it not been for the support of those closest to me. I'd like to thank Daniel for putting up with my stressing for the past few months and for cooking the occasional dinner for me while I worked on this thesis and other honours classes. Last but not least, I am grateful to my parents and brother, Nick, for supporting me through this entire process despite being thousands of miles away. Without them, this thesis would most definitely have not come to fruition.

## *List of figures and tables*

### Figures:

Figure 1. Map of Yolngu country (Source: Morphy 1983: xxiv).....	11
Figure 2. Yolngu subgroupings (modified from Wilkinson 1991: 11).....	12
Figure 3. Southern Yolngu (modified from Wilkinson 1991: 13).....	12
Figure 4. Consonant strength scale.....	23
Figure 5. Consonant strength scale in Yolngu .....	24

### Tables:

Table 1. Yolngu consonant alternations .....	10
Table 2. Alternating suffixes.....	10
Table 3. Phoneme inventory of Yolngu .....	13
Table 4. Wubuy consonant alternations, following Heath 1984 .....	39
Table 5. Surface form correspondences between Wubuy and Yolngu.....	41
Table 6. Variation: suffix realisation in Djambarrpuynu (Wilkinson 1991)....	46
Table 7. Variation: suffix realisation in Djapu (Morphy 1983).....	47

*List of abbreviations:*

ACC	Accusative
ALL	Allative
ASSOC	Associative
DAT	Dative
ERG	Ergative
FOC	Focus
INSTR	Instrument
LOC	Locative
OBL	Oblique
OBLS	Oblique Stem
OR	Originative
OT	Optimality Theory
PER	Perlative

## CHAPTER 1. INTRODUCTION

A number of varieties of Yolngu Matha display a common pattern of continuant-stop alternation. In Yolngu Matha (hereafter Yolngu), these alternations have hitherto been analysed as lenition with an underlying stop weakening to a corresponding glide (eg. Gaalpu, Wood 1978). Examples of these alternations are shown in (1-1)-(1-4). In (1-1), the dative suffix /-ku/ surfaces with an initial stop following a root-final nasal, whereas in (1-2) it surfaces with an initial glide following a root-final glide. Similarly in (1-3) and (1-4), the stop variant of the associative suffix surfaces following a nasal and the glide variant appears following a vowel.<sup>1</sup>

<u>Gaalpu</u>			
(1-1)	pu:ɹum-ku	→	pu:ɹumku ‘fruit-DAT’
(1-2)	ɹakaj-ku	→	ɹakajwu ‘the top- DAT’
(1-3)	wa:jin-puj	→	wa:jinpuj ‘animal-ASSOC’
(1-4)	kaŋa-puj	→	kaŋawuj ‘spear-ASSOC’

In some other languages, such as Wubuy (a.k.a. Nunggubuyu, Heath 1984), similar alternations have been analysed in the other direction, with a hardening rule converting an underlying semivowel to a corresponding stop (see also Baker 2009). Examples of this alternation are shown below. The stop variant of the locative suffix surfaces following a nasal (1-5) and the continuant variant surfaces following a vowel (1-6).

(1-5)	a-ɭaɹɹ-ɹuc	→	aɭaɹɹtuc ‘chin-LOC’
(1-6)	a-ɭakuɭa-ɹuc	→	aɭakuɭaruc ‘lip-LOC’

The focus of this thesis is on the analysis of two such instances of alternation: lenition in Yolngu and hardening in Wubuy.

Yolngu presents us with a case of lenition conditioned by a bilateral context. That is, the alternation is triggered, crucially, by both the preceding *and* following segments. Cases of lenition conditioned by a two-sided context are very common (see Kirchner 1998, 2001; Lavoie 2001 for examples). However, analyses of such cases have not been handled well by Optimality Theory (Prince & Smolensky 2004[1993]) and

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<sup>1</sup> I have represented examples throughout the thesis using IPA, rather than the local orthography.

Autosegmental Phonology (Goldsmith 1979). Briefly, the difficulty is in capturing the two-sided context that conditions these alternations. I discuss the issues surrounding these analyses in chapter 3.

In this thesis, I present the first theoretically informed investigation of lenition in Australian language couched in the framework of Optimality Theory (hereafter OT). While numerous phonetic studies have been conducted on the articulatory and acoustic properties of Australian Aboriginal languages, extended theoretical treatments of the phonology of Australian languages are still relatively rare (see, however, Baker 2008). Furthermore, there has not been a prior theoretically informed discussion of these kinds of alternations in the literature on Australian languages nor in phonological theory. Therefore, in discussing the underlying motivation of lenition and how it interacts with phonotactics to produce surface forms, this thesis contributes to both the literature on Australian languages and the wider field of phonological theory.

This chapter is structured as follows. I first discuss the phenomenon of lenition. I suggest a basic theoretical understanding of it and argue for the necessity of the theoretical account presented in this thesis. Secondly, I provide a brief overview of continuant-stop alternations in Australian languages. Finally, I describe the mechanics of the theoretical framework, OT.

## 1.1 LENITION: A WORKING DEFINITION

Lenition, despite its pervasiveness, is a surprisingly problematic area for phonological theory (see Bauer 2008; de Carvalho et al 2008 for an extended discussion). At its broadest, it is conceived of as some form of ‘weakening’ of segments. What is considered lenition is generally agreed upon and this includes processes such as deletion, spirantisation, voicing, and so forth. How to account for these processes phonologically, however, is still an open question. Lavoie (2001: 12-21) outlines four main phonological approaches to lenition found in the literature:

### (1-7) Typology of lenition

- a. Lenition as deletion of feature specifications
- b. Lenition as an increase in sonority
- c. Lenition as effort minimisation
- d. Lenition as a decrease in gestural duration and magnitude

As Kaplan (2010) points out, these approaches have a common thread: they define lenition in phonetic or quasi-phonetic terms. Whether all instances of lenition can really be subsumed under one umbrella is a question beyond the scope of this thesis. I take the working approach that lenition is *not* a single, unified phenomenon, but is rather a “tightly knit network of sound patterns with overlapping causes and properties” (Kaplan 2010: 4). My goal in this thesis is modest: it is to propose an analysis of one such pattern in this “tightly knit network”.

In chapter 3, I follow a proposal by Kingston (2008) whereby lenition is analysed as an increase in intensity of a target segment in relation to the surrounding segments. Phonetic intensity is often seen as a phonetic correlate of phonological sonority (Parker 2002). Therefore, the analysis presented in this thesis is, broadly speaking, one in which lenition is considered as an increase in sonority (1-7b). Specifically, I discuss an example of a two-sided conditioning environment. The triggering environment of lenition can of course be one-sided (eg. post-vocalic spirantisation in Tiberian Hebrew: Malone 1993). However, lenition conditioned by two-sided contexts is very common (Lavoie 2001), thus, there needs to be an analysis of lenition that is able to satisfactorily account for the role of a two-sided environment. I discuss this issue in chapter 3 and show that previous analyses in a range of frameworks have failed to adequately account for this fact.

## 1.2 ALTERNATION PATTERNS IN AUSTRALIAN ABORIGINAL LANGUAGES

In this thesis, I describe alternation patterns in Yolngu and Wubuy. These are shown in the following examples:

### Djapu (Yolngu)

- (1-8) wa:raŋ-**puj** → wa:raŋ**puj** ‘dingo-ASSOC’  
 (1-9) wapiti-**puj** → wapiti**wuj** ‘sting ray-ASSOC’

### Wubuy

- (1-10) ŋa-**w<sub>2</sub>aŋ** → ŋa**w<sub>2</sub>aŋ** ‘I bit it (NEUT class)’  
 (1-11) nun-**w<sub>2</sub>aŋ** → nun**paŋ** ‘you bit it (NEUT class thing)’

Here we see an alternation between stops and continuants. In Yolngu, underlying stops become continuants between non-nasal sonorants. In Wubuy, on the other hand, underlying continuants surface as stops following nasals and stops. Despite the

differences in directionality, however, I show that both patterns can be accounted for using the same constraint hierarchy (see chapter 3 and 4).

Apart from these, there are a number of other lenition processes observable both diachronically and synchronically in other Australian languages. Widespread patterns of historical lenition of stops to continuants have been noted by Round (2010)<sup>2</sup>. These changes occur between non-nasal sonorants and interact with general phonotactic constraints in characteristic ways (see chapter 3). Namely, this process is blocked by preceding [-continuant] segments, ie. stops and nasals.

Moreover, these alternations are structure-preserving insofar as the alternation does not introduce a new segment into the phonemic inventory of the language. These alternations differ from those in a language such as Spanish, in which a new allophone is introduced into the phonological system (eg. Mascaro 1984). Therefore, in positions where these alternations occur, the contrast in [ $\pm$ sonorant] between the alternating segments is neutralised.

Segmental context, however, is not the only possible conditioning factor. In Yir-Yoront, for example, Alpher (1988) notes a stop-continuant alternation pattern that is stress-conditioned. The alternation affects post-vocalic segments, with the stop occurring in contexts following primary stress and the glide occurring in contexts where it is normally unstressed. This is an example of ‘post-tonic strengthening’. These alternations (Alpher 1988: 189) are exemplified below (primary stress is represented by an acute accent). In (1-12) and (1-14), a stop surfaces in post-tonic position, whereas in (1-13) and (1-15) a glide occurs when the preceding vowel does not bear primary stress.

- |                |               |
|----------------|---------------|
| (1-12) púꞤ     | ‘arm’         |
| (1-13) puj-mál | ‘right-hand’  |
| (1-14) kác     | ‘neck, stalk’ |
| (1-15) kaj-pál | ‘lily pad’    |

Similarly, in Ndjébbana (McKay 2000), stops geminate and lenite in root-initial position, intervocalically following prefixes. The two processes are exemplified in the

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<sup>2</sup> Round (2010) suggests that 10% of Australian languages show some form of synchronic reflex of changes in which stops have become continuants.

following examples. Gemination occurs when the stop precedes a vowel that bears phonemic stress and vowel length, as in (1-16). In (1-17), lenition occurs in the same environment, but when the following vowel does not bear primary stress and vowel length. In word-initial position, neither process applies as in (1-18). Notably, however, this is a highly lexicalised alternation that only applies to certain lexemes.

- (1-16) Gemination: ka-**cc**úwa ‘he is sick’  
(1-17) Lenition: ka-jawé-la ‘he was sick/died’  
(1-18) Neither: **c**awé-la ‘be sick/die’

It seems that stress and prosodic constituency do play a role in conditioning alternations in some languages. Simpson (1979), for example, documents segmental length alternations in Warumungu conditioned by a range of factors including syllable and metrical structure. It is quite possible that some or all of these factors are also relevant to the alternations in Yolngu. Currently, however, we lack the detailed phonetic and phonological descriptions necessary to investigate the possible influence of these factors. These phonological alternations are presumably related to the phonetic phenomenon of post-tonic strengthening. Phonetic studies have shown that the position of the segment with regards to the tonic syllable can have effects on the ‘strength’ or ‘weakness’ of obstruents (see for example Butcher & Harrington 2003; Pentland & Ingram 2003). In Warlpiri for, example, Butcher & Harrington (2003) found that post-tonic consonants were hyperarticulated, suggesting that prosodic factors can influence the realisation of consonants.

### 1.3 THEORETICAL FRAMEWORK: OPTIMALITY THEORY

In this thesis, my analysis will be couched in Optimality Theory (OT: Prince & Smolensky (2004[1993])). OT is a constraints-based model of grammar. Here it differs from generative frameworks in which output forms are the result of the application of a series of rules to an input. Instead, grammars are conceived as a hierarchy of violable universal constraints. Well-formed outputs are a result of the resolution of conflicts between these ranked constraints through parallel evaluation.

A standard OT grammar consists of three components: GEN, CON and EVAL. GEN is responsible for producing the range of all possible outputs given a particular input (or underlying representation). CON is a component of the grammar that consists of the set of violable universal constraints. While constraints are universal, their rankings with respect to each are not. Hence, due to these different rankings, we see dif-

ferences in the grammar of different languages. Crucially, constraints are violable; that is, it is possible for a candidate to be optimal and still violate constraints in the constraint hierarchy. There are two families of constraints: markedness and faithfulness. Markedness constraints are constraints on output forms that reflect the preference of unmarked types of structures, thereby driving alternations. Faithfulness constraints, on the other hand, prohibit differences between input and output. Constraints assign violation marks to candidates thereby giving EVAL a means to assess each candidate. Three common faithfulness constraints are defined below (McCarthy & Prince 1995: 264):

- (1-19) MAX-IO: Every segment of the input has a correspondent in the output (ie. no phonological deletion)
- (1-20) DEP-IO: Every segment of the output has a correspondent in the input (ie. prohibits phonological epenthesis)
- (1-21) IDENT-IO[ $\alpha$ F]: Output correspondents of an input [ $\alpha$ F] segment are also [ $\alpha$ F].

The optimal candidate, ie. the attested surface representation, is selected by EVAL. Candidates are evaluated by EVAL against the language-particular constraint hierarchy. The optimal candidate is the one that incurs the fewest serious violations of the constraints. So candidates that violate higher ranked constraints are eliminated and the optimal candidate is selected once all other candidates have been eliminated due to their violation of dominating constraints. Below I demonstrate the mechanics of OT using a concrete example adapted from Kager (2007[1999]: 14).

Dutch has a rule of coda-devoicing that can be formalised in the following markedness constraint:

- (1-22) \*VOICED-CODA: Obstruents must not be voiced in coda position.  
(Kager 2007[1999]: 14)

A second constraint is a faithfulness constraint that requires the preservation of the input value of the feature voice in the output.

- (1-23) IDENT-IO[VOICE]: The specification for the feature voice of an input segment must be preserved in its output correspondent.  
(Kager 2007[1999]: 14)

In Dutch, the constraint hierarchy is \*VOICED-CODA » IDENT-IO[VOICE], where “»” is to be read as ‘dominates’. The evaluation is displayed in a tableau (1-24) which arrays an input (in slashes) at the top left hand corner and a partial series of candidates at the left. The hierarchy of constraints are listed at the top from left to right, heading successive columns. Crucial constraint rankings are marked by solid lines that separate each column (if the ranking of two constraints cannot be determined, then they are separated by a dotted line). Violation of a constraint is represented by an asterisk (\*) in the corresponding cell and the exclamation mark (!) is indicative of a fatal violation. The optimal candidate is indicated by the symbol ‘◀’.

(1-24) Dutch final obstruent devoicing

	/bɛd/ ‘bed’	*VOICED-CODA	IDENT-IO[VOICE]
◀ a.	bɛt		*
b.	bɛd	*!	

Here (1-24a) is selected as the optimal candidate since (1-24b) violates the high-ranked \*VOICED-CODA. Crucially (1-24a) is selected despite violating low-ranked IDENT-IO[VOICE].

In this thesis, I show that the generalisations from the alternation pattern in Yolngu and Wubuy can be accounted for in an OT analysis. However, despite this, the OT analysis presented faces a number of challenges. Here I briefly summarise the two difficulties. Firstly, the OT analysis is unable to account for the variation in suffix realisation that occurs since it is assumed that only one optimal candidate is selected. This is a problem faced by generative formalisms in general, not just OT. Secondly, it is difficult to see how an instance of counterbleeding opacity as exemplified by final vowel deletion should be accounted for in OT. These problems are interesting challenges for the theoretical formalism. I discuss these in detail in chapter 5.

#### 1.4 STRUCTURE OF THIS THESIS

The organisation of this thesis is as follows. In chapter 2, I present a brief overview of the Yolngu varieties that are the focus of this thesis. I describe the phonemic inventory and the environments in which lenition occurs. Chapter 3 presents an analysis of lenition couched in OT and argues against other potential theoretical accounts. I extend this analysis to account for hardening in Wubuy in chapter 4. Finally in chapter 5, I discuss some residual issues with the analysis presented.

## CHAPTER 2. YOLNGU MATHA

This chapter introduces the continuant-stop alternations in a number of Yolngu Matha varieties: Djambarrpuyngu, Djapu and Gaalpu. I begin by showing examples of these alternations and the environments in which they occur. I then discuss the linguistic context of Yolngu Matha, highlighting the fact that certain sociolectal distinctions are a necessary consideration in my discussion of continuant-stop alternations both historically and synchronically. In 2.3, I present the phonological inventory of the Yolngu Matha varieties I am considering and discuss the unclear status of the stop contrast in these languages. I also examine, in 2.4, the conditioning environments for continuant-stop alternations and argue for a bilateral context. Finally, I briefly discuss other non-phonological conditioning factors in 2.5.

### 2.1 CONTINUANT-STOP ALTERNATIONS IN YOLNGU

In this thesis, I will be making reference to three varieties of Yolngu ([ju:lŋu]): Gaalpu (Wood 1978), Djapu (Heath 1980; Morphy 1983), and Djambarrpuyngu (Heath 1980; Wilkinson 1991).<sup>1</sup> These varieties evince an alternation between labial, dorsal and laminal stops, and the corresponding glides. Examples of this alternation are shown below:

<u>Djapu</u>		
(2-1)	wa:jin- <b>ku</b>	‘animal-DAT’
(2-2)	pumparu- <b>w(u)</b> <sup>2</sup>	‘rock-DAT’
(2-3)	wa:raŋ- <b>puj</b>	‘dingo-ASSOC’
(2-4)	wapiti- <b>wuj</b>	‘sting ray-ASSOC’

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<sup>1</sup> The data presented in this thesis has been taken from the listed sources. No fieldwork has been undertaken to obtain primary data.

<sup>2</sup> There is a vowel deletion rule that is specific to Dhuwal of which Djapu and Djambarrpuyngu are varieties. This is discussed in sections 2.4 and 5.2.

- (2-5) mijalk-**ɬ**u                    ‘female-ERG’  
 (2-6) ju:lɲu-**j**(u)                ‘people-ERG’  
 (2-7) karapa-**j**(u)                ‘spear-INSTR’
- (2-8) ɬukun-**k**uŋ(u)            ‘rubbish-OR’  
 (2-9) pa:pa-**w**uŋ(u)            ‘father-OR’

Gaalpu

- (2-10) wa:jin-**p**uj                ‘animal-ASSOC’  
 (2-11) kaŋa-**w**uj                ‘spear-ASSOC’
- (2-12) pu:ɲum-**k**u                ‘fruit-DAT’  
 (2-13) ɬakaj-**w**u                ‘the top-DAT’

The examples above show the alternation pattern between suffix-initial stops and continuants. Yolngu is a suffixing language and so the only environment in which this morphophonemic process can occur is in suffix-initial position. Following stop and nasal-final stems, suffixes are realised as stop-initial, as in (2-1). Following continuant-final stems, they are realised as continuant-initial, as in (2-2). Note that stops do occur between sonorants root-internally:

- (2-14) paɬka                    ‘upper arm/armlet/sleeve’

This alternation has hitherto been analysed as a lenition process by which an underlying stop lenites to a surface glide. Specifically, lenition occurs at the morpheme boundary following semivowels, liquids and vowels, segments that together can be classified as a class of continuants. Moreover, it seems that the following vowel is also crucial in conditioning this change (see section 2.4). This lenition rule can be stated simply as (2-15):

- (2-15) [-son] → [+cont] / [+cont] + \_\_ [+cont]<sup>3</sup>

It must be noted that this rule does not account for differences in the behaviour of apical segments. In fact, this predicts that apical segments should also show alterna-

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<sup>3</sup> As such, this rule predicts that stops could potentially become fricatives. However, Australian languages are noted for the general absence of fricatives. As we shall see the analysis presented in chapter 3 explicitly predicts that this would not occur.

tions, when they do not. I discuss the status of apicals in section 3.4. The correspondences between stops and continuants are summarised in Table 1 below:

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

TABLE 1. Yolngu consonant alternations

A number of grammatical morphemes show this regular alternation pattern. The relevant morphemes are shown below:

ERG/INSTR	t̥u~ju
DAT	ku~wu
OR	kuŋu~wuŋu
OBL	kal~wal
OBLs	kalaŋu~walaŋu
PER	kur~wur
ASSOC	puj~wuj

TABLE 2. Alternating suffixes

Several other verbal suffixes such as the Inchoative /-t̥i/~/-ji/ have been noted to show similar alternations (see Wilkinson 1991; Wood 1978). In this thesis, however, I will only address nominal suffixes, since it is not clear to what extent verbal suffixes are productive synchronically.

## 2.2 YOLNGU MATHA: AN OVERVIEW

In this section, I provide a brief overview of Yolngu Matha, the overarching dialect chain of which Djambarrpuynghu, Djapu and Gaalpu are members. The linguistic context is intricate and reflects societal organisation. In the context of the alternations considered in this thesis, these distinctions have a number of implications. Namely, the Dhuwal/Dhuwala distinction is important for our consideration of word-final vowel deletion (see sections 2.4 & 5.2) and the presence of a surface fortis/lenis stop contrast (see section 2.3.1). In what follows, I provide an overview of

the linguistic context of Yolngu Matha, focussing primarily on the Dhuwal/Dhuwala distinction.

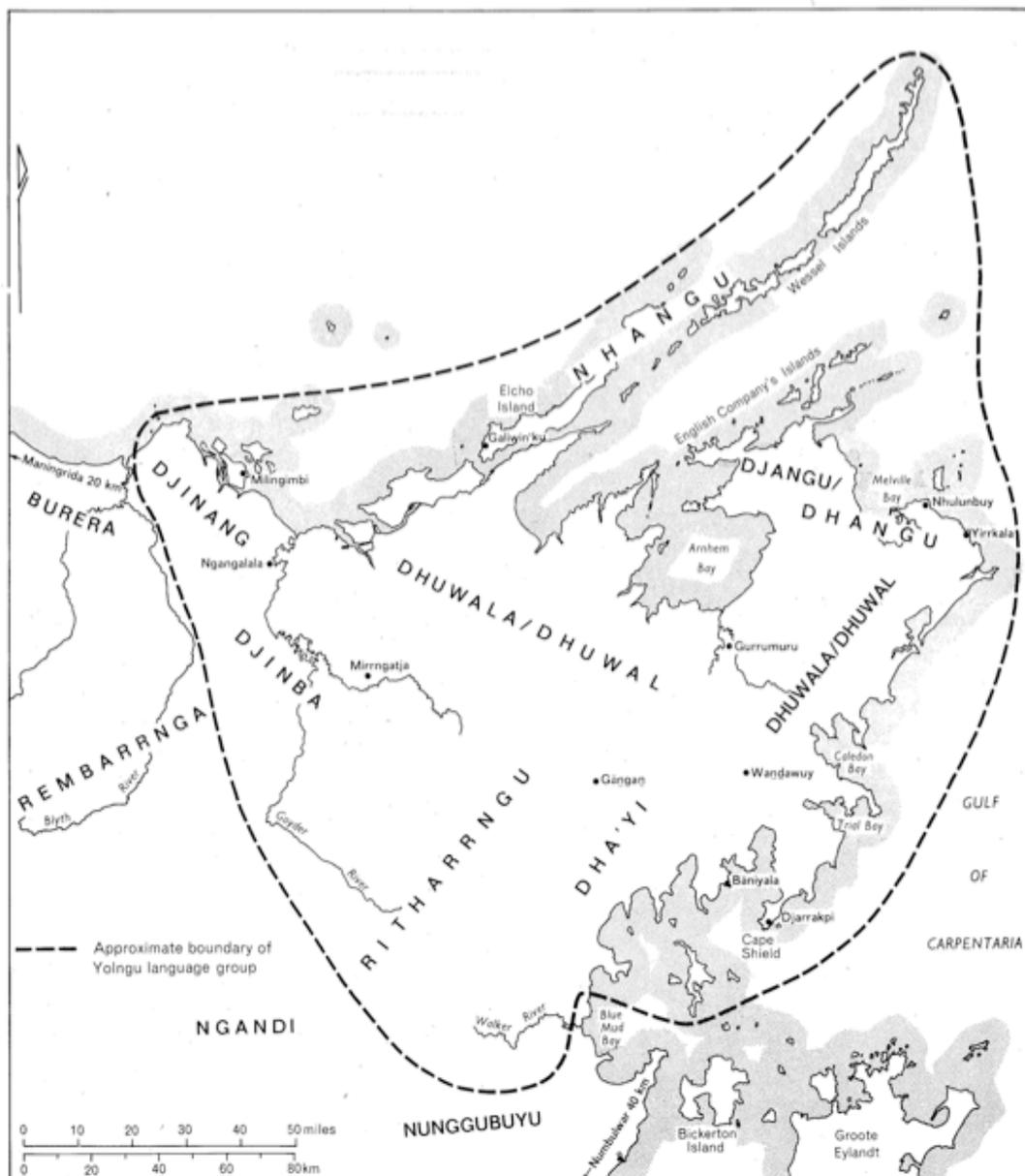


FIGURE 1. Map of Yolngu country (Source: Morphy 1983: xxiv)

Yolngu Matha is a dialect chain that is a member of the Pama-Nyungan family. It consists of a number of varieties spoken in north-eastern Arnhem Land in the Northern Territory, Australia. Interestingly, it is surrounded by various members of prefixing non-Pama-Nyungan languages, such as Wubuy (a.k.a. Nunggubuyu: see Chapter 4). There are three major sub-groupings of Yolngu (Wilkinson 1991): Western, Northern, and Southern.

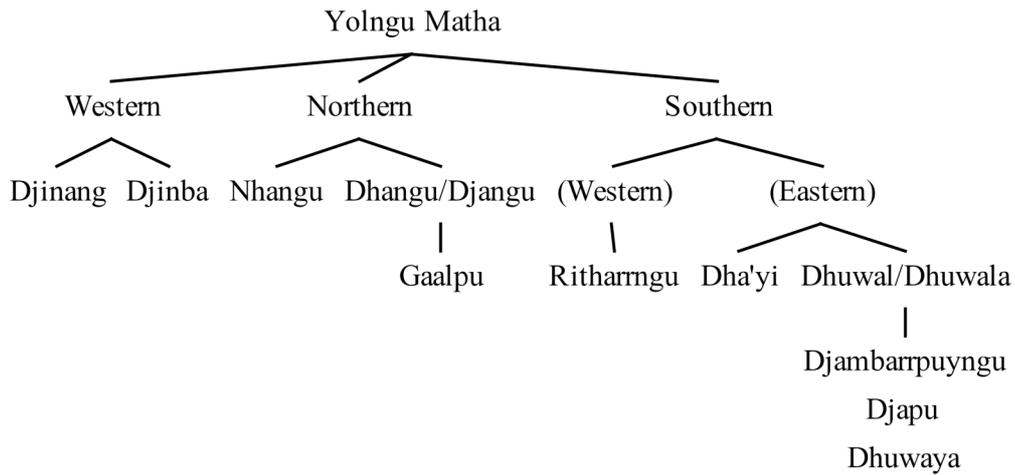


FIGURE 2. Yolngu subgroupings (modified from Wilkinson 1991: 11)

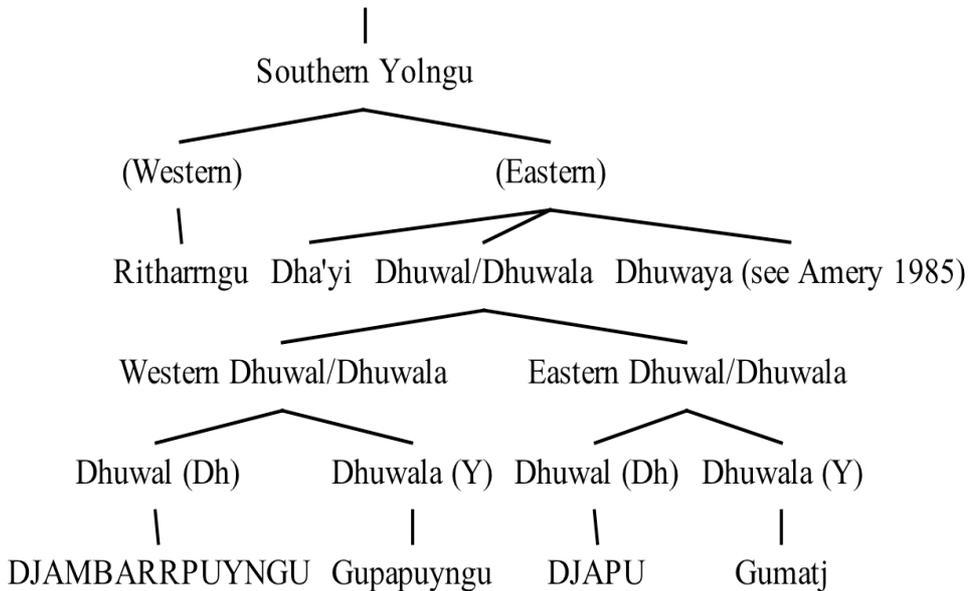


FIGURE 3. Southern Yolngu (modified from Wilkinson 1991: 13)

Dhuwal/Dhuwala is a language variety and is a branch of the “Southern” group. Djapu and Djambarrpuynu are dialects of this language and are considered Dhuwal dialects. The distinction between Dhuwal and Dhuwala is primarily a sociolectal one (Morphy 1983) and it also has a phonological reflex, namely, final vowel deletion (see sections 2.4 and 5.2). This two-way distinction maps onto the Yolngu social classification system. As in many other Australian Aboriginal communities, Yolngu society is exhaustively divided into two moieties (‘halves’) called Yirritja (Y) and Dhuwa (Dh). Dhuwal speakers are members of the Dhuwa moiety, whereas Dhuwala speakers (Gupapuyngu and Gumatj) are members of the Yirritja moiety. All speech communities have members from both moieties and children grow up proficient in both sociolects (see Morphy 1983). Speakers of Gaalpu, a Dhangu variety of

the “Northern” group are also considered to be in the Dhuwa moiety (Wood 1978; Amery 1985).

While the distinction between Dhuwal and Dhuwala is a sociolectal one, there is nonetheless a dialectal difference within that crosscuts this distinction. So Gumatj (Dhuwala) is more similar to Djapu (Dhuwal) than it is Gupapuyngu, even though they are both Dhuwala varieties. The distinction here seems to be a geographic one, with Djapu and Gumatj spoken further east than Djambarrpuyngu and Gupapuyngu historically (Morphy 1983; Wilkinson 1991). Presently, speakers of Yolngu are concentrated in three main communities: Milingimbi, Galiwin’ku (Elcho Island) and Yirrkala (see Figure 1 above).

For the remainder of the thesis, the term “Yolngu” refers to the dialects I discuss here, namely Djambarrpuyngu, Gaalpu and Djapu. Having given an overview of the linguistic and social context of Yolngu Matha, I describe its phoneme inventory in the next section, and issues with its phoneme inventory in the subsequent sections.

### 2.3 PHONEME INVENTORY

	bilabial	lamino- dental	apico- alveolar	apico- retroflex	lamino- palatal	dorsal	glottal
fortis stop	p	t̪	t	ɽ	c	k	ʔ
lenis stop			(d) <sup>4</sup>	ɖ			
nasal	m	n̪	n	ɳ	ɲ	ŋ	
laterals			l	ɭ			
trill/tap			r				
semivowel	w			ɻ	j	(w)	

TABLE 3. Phoneme inventory of Yolngu

The phoneme inventory of Yolngu is fairly typical of an Australian language. As in many Australian languages, it has a relatively “flat” inventory with a 6-place supralaryngeal contrast in stops and nasals, and a two-way contrast in laterals. There are three semivowels (/w/, /j/ and /ɻ/) and an apico-alveolar trill/tap /r/.

<sup>4</sup> Wood (1978) suggests that there is not sufficient evidence to maintain a contrast between [t] and [d] in Gaalpu, 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.

Yet a number of issues remain regarding the segmental inventory: (i) the nature of the stop contrast, and (ii) the nature of the glottal stop. I take up the first of these in the next section. I discuss the glottal stop in section 3.7.

### 2.3.1 THE NATURE OF THE STOP CONTRAST

The nature of the stop contrast in Yolngu has gained considerable attention in the literature on the Yolngu languages as a whole. A historical process of lenition lenited intercontinuant labial, dorsal and laminal lenis stops in Djapu, Djambarrpuynu and Gaalpu, thereby eliminating the surface contrast for fortis/lenis in all places of articulation apart from the apical series (see Table 1). Examples of contrastive apico-retroflex stops are shown below:

	<u>Gaalpu</u>	
(2-16)	jarat̪a	‘line, row’
(2-17)	jarad̪a	‘lightning’

According to Wilkinson (1991), Djambarrpuynu maintains, somewhat precariously, a fortis/lenis stop contrast in intercontinuant position. This contrast, however, is only present in a few morphemes (Wilkinson 1991). In word-initial and word-final position, these stops are neutralised. Following nasals and stops, this contrast is also neutralised.

The intercontinuant environment of the stop contrast raises the question of whether suffix-initial stops are indeed contrastive. In the Yolngu varieties that categorically maintain the stop contrast, suffix-initial stops are contrastive for fortis/lenis (eg. Ritharrngu: Heath 1980). However, in the Yolngu varieties discussed in this thesis, it is not clear that the stop contrast is still active in suffix-initial position. Stop-initial suffixes which were historically fortis (such as associative /-puj/) also alternate, so it seems that the fortis/lenis contrast is neutralised in this position, as in root-internal position.

The fortis/lenis distinction itself has received various labels: fortis/lenis, voiced/voiceless, geminate/singleton and tense/lax. Correspondingly, three different analyses, i) segmental (eg. Lowe 1960), ii) geminate (eg. Schebeck 1976) and iii) prosodic (eg. Wood 1978) have been proposed. The actual phonetic characteristics of this contrast where they do exist are still under investigation. In the case of Ritharrngu, Heath (1980) suggests that the fortis/lenis stop oppositions “are mani-

fested phonetically by duration, tenseness and often by voicing” (p. 8). In a phonetic study of this contrast, Butcher (1995) found fortis stops to be on average three times as long as lenis stops. Additionally, fortis stops were characterised by an active abduction of the glottis, such that voicing was curtailed. Lenis stops, on the other hand, showed a prolonged pulsing of the glottis. This is at least the case in Gupapuyngu and other Yolngu dialects where a contrast still exists in all places of articulation. Butcher (1995) further notes that phonetically fortis stops in Djapu lack voicing, suggesting that the active abduction of the vocal folds to prevent voicing is still a characteristic of these sounds despite not being phonemically contrastive.

In the analysis that follows in chapter 3, I work on the assumption that the stop contrast is eliminated in all but the apical series of stops and in all positions (both root-internal and suffix-initial). I use the voiceless symbol throughout for non-contrastive stops and the voiced symbol for lenis stops where appropriate. Phonemically fortis stops are represented, where necessary, with an asterisk (\*), eg. /k\*/. In section 5.1, I address the problems with this assumption with reference to the variation in suffix realisation.

#### 2.4 A NOTE ABOUT ENVIRONMENTS

In 2.1, I introduced the continuant-stop alternations in Yolngu. Specifically I suggested that both the preceding environment and the following environment were crucial in conditioning the lenition process. In this section, I examine the role of the following vowel in conditioning lenition, emphasising its importance in regards to the historical process of lenition.

In Gaalpu (Wood 1978) and Djambarrpuyngu (Wilkinson 1991), the stated phonological environment in which lenition occurs was summarised in (2-15), reproduced below as (2-18):

(2-18) [-son] → [+cont] / [+cont] + \_ [+cont]

The morpheme boundary has been included to capture the fact that synchronic lenition only occurs in suffix-initial position. Morphy (1983) does not describe the role of the following vowel in conditioning lenition in Djapu. In her analysis, the final segment of the preceding stem is sufficient to determine whether a suffix-initial stop will lenite or not. This discrepancy begs the question: what evidence is there for the role of the following vowel in conditioning lenition synchronically?

It is difficult to test the synchronic role of the following vowel in determining the alternation. The basic syllable structure in Yolngu is CV(C). Suffixes, though not word-minimal, nonetheless consist of a whole number of syllables; that is, they meet the syllable template of the language (see however section 5.2). Morphy (1983), Wood (1978), and Wilkinson (1991) all assert that the environment in which lenition occurred historically was intercontinuant position; that is, in the environment in which stops were contrastive. So the crucial point is that both the preceding and following segments were necessary to condition the change (see also Round 2010). Of course, the diachronic environment for lenition need not be the same as the synchronic. That being said, it is still plausible that the conditioning environment is still two-sided in Yolngu synchronically.

In Djapu and Djambarrpuyngu, however, suffixes do surface as a single consonant, but only in word-final position following vowel-final roots that are more than two syllables in length.<sup>5</sup> This vowel deletion rule is the primary distinguishing characteristic between Dhuwal and Dhuwala. Examples of this are shown below.

	<u>Dhuwal</u>	<u>Dhuwala</u>	
(2-19)	ju:lɲu-j	ju:lɲu-ju	‘people-ERG’
(2-20)	pumparu-w	pumparu-wu	‘rock-DAT’
(2-21)	karapa-j	karapa-ju	‘spear type-INSTR’

In Gaalpu, the suffixes that lenite never show these variants and the segmental target for lenition must necessarily be followed by a vowel. That being said, vowel deletion occurs with some other non-alternating suffixes (see Wood 1978), following vowel-final stems.<sup>6</sup>

(2-22)	jumurku-ɲa	→	jumurku-ɲ	‘children-ACC’
(2-23)	ɲaliŋku-ma	→	ɲaliŋku-m	‘ours-FOC’

Crucially, the consonant alternation pattern is not affected by vowel deletion, and following vowels, the lenited variant occurs. If we pursue an analysis in which both

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<sup>5</sup> Heath (1980) suggests that there may be minor differences between Djambarrpuyngu and Djapu in the manifestation of this vowel deletion rule.

<sup>6</sup> Wood (1978) does not suggest that vowel deletion occurs for the CV suffixes that I discuss in this paper. However, he does observe that the OR /-walang(u-)/ does undergo vowel deletion word-finally. In this case, this occurs regardless of the conditioning environment for the suffix alternation.

flanking segments are necessary for prompting lenition, we are drawn to the conclusion that this is a form of counterbleeding-on-environment opacity, a particular problem for analyses in OT (Bakovic 2007). I return to a discussion of this in section 5.2.

For the present purposes of this thesis, I pursue an analysis that assumes a bilateral conditioning environment for suffix-initial alternation. This is further developed in chapter 3 in which I propose an OT-account of this lenition pattern. In the next section, I make a brief note of morphological factors that condition the suffix alternation.

## 2.5 OTHER NON-PHONOLOGICAL CONDITIONING FACTORS

So far I have discussed the phonological conditioning factors of the suffix-initial alternations. There are, however, a number of other conditioning factors. Morphological factors seem to determine the realisation of the suffix to some extent. There seems to be a tendency for the lenited allomorph to appear following stems of three or more syllables (see Wilkinson 1991; Heath 1980; see also Simpson 1979 on length alternations in Warumungu). In Djambarrpuyngu, Wilkinson (1991) suggests that this is merely a tendency and alternations occur with both shorter and longer stems. Morphy (1983) suggests that the identity of the suffix is also a potential factor that determines its phonological form, that is whether or not the suffix is a verbal or nominal suffix can affect its allomorphy. It is clear then that morphology and syllabic structure play a part in conditioning suffix alternation. In this thesis, however, I do not account for these morphologically determined alternations.

## CHAPTER 3. LENITION: A FORMAL ANALYSIS

In this chapter, I present a formal analysis of the lenition pattern in Gaalpu and Djapu. This analysis is couched in OT (Prince & Smolensky 2004[1993]). Specifically, I adopt a proposal by Kingston (2008). I first outline Kingston's proposal and then show that by modifying Kingston's original markedness constraint, we are able to succinctly account for the generalisations we have made about continuant-stop alternations in Yolngu. Other proposals are considered and argued against and a number of unresolved issues with the analysis are discussed, notably the difficulty in analysing the behaviour of the glottal stop.

### 3.1 LENITION AS AN INCREASE IN INTENSITY

Kingston (2008) presents an analysis of lenition that is phonetically motivated. Specifically, he argues that the openness of flanking consonants can determine whether a stop lenites. Kingston contends (contra Kirchner 1998; 2001) that lenition is not due to articulatory undershoot per se. Instead, he argues that speakers choose a more open articulatory target to produce a desired acoustic consequence. Lenition's function is thus to reduce the extent to which a segment interrupts a stream of speech and it achieves this by increasing the affected segment's intensity.

In view of this, Kingston posits a markedness constraint that prohibits segments which are specified as [-continuant] from occurring in particular segmental contexts. This constraint is drawn from a hierarchy of markedness constraints whose relative ranking reflects the sonority hierarchy:

- (3-1) \*Voiceless Stop / X\_Y » \*Voiced Stop/X\_Y » ... \*Semivowel/X\_Y  
(ie. Voiceless stops are more marked in the environment X\_Y than voiced stops, which are more marked than semivowels)

Here, X and Y specify lower limits in sonority value for conditioning segments. Smith (2008) argues for the intrinsically contextual nature of sonority-increasing lenition constraints, the type which we are considering in this paper. In her view, not unlike Kingston's, these markedness constraints encode the markedness of particular phonological feature values in a given environment.<sup>1</sup>

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<sup>1</sup> While Kingston argues for perceptual motivations behind a markedness constraint, the phonetic and phonological components are kept distinctly separate, contra Kirchner (1998, 2001). The reasons for

### 3.2 LENITION IN YOLNGU

In Yolngu, stops lenite following a liquid, semivowel or vowel (ie. continuants) and preceding a vowel. Utilising Kingston's proposal, therefore, X is any segment that is as sonorous as or more sonorous than a liquid (L) and Y is anything as sonorous as a vowel (V). This results in the following constraint:

- (3-2) \*[-CONTINUANT]/L\_V: Assign one violation mark for every segment specified as [-continuant] that occurs following any segment as or more sonorous than a liquid and before a vowel.

We are able to generalise the environment since these segments are all specified for the feature [+continuant]. Using feature representation, we could define our lenition-causing markedness constraint as follows:

- (3-3) \*[-CONTINUANT]/[+CONT]\_\_[+CONT]: Assign one violation mark for every segment specified as [-continuant] that falls in between two continuants.

Yet as it is, this constraint, as I discuss below, makes a number of wrong predictions about the alternations in Yolngu (see section 3.6). Importantly, it predicts that stops could potentially lenite to fricatives when they do not, and nasals would lenite too when they do not. Moreover, if lenition serves to increase the intensity of a stream of speech, as Kingston (2008) suggests, then it seems that continuancy (the degree of stricture in the vocal tract) is not the best reflection of intensity. Instead, acoustic intensity is often the phonetic correlate of sonority (Parker 2002). In view of this, I propose a modification of Kingston's model in favour of using the feature [sonorant] instead of [continuant]. Our new markedness constraint is formulated below:

- (3-4) \*[-SON]/[+SON]\_\_[+SON]: Assign one violation mark for every segment with the feature [-sonorant] that falls in between two sonorants.

(3-4) is a generalised surface constraint and I will refer to this as Sonority Preservation, or SONPRES, in the rest of this paper.

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which it is necessary to keep phonetic and phonological components separate are beyond the scope of this paper. However, I refer the reader to Kingston's (2008) original proposal and Smith (2008) for supporting arguments. In this paper, I follow Kingston's proposal, keeping the phonetic and phonological components of the grammar separate.

(3-5) SONPRES: Assign one violation mark for every segment with the feature [-sonorant] that falls in between two sonorants.

This constraint is violated by every stop that surfaces between two sonorants. According to this constraint, lenition is motivated by the need to maintain or increase *sonority* (and not the openness of constriction, per se) across a stream of speech; hence the flanking segments are specified as [+sonorant].

This constraint differs from Kingston's original proposal in two ways: (i) it prohibits [-sonorant] segments instead of [-continuant] segments from appearing in a particular segmental context, and (ii) the flanking environments are not defined in terms of the lower limits in sonority value. The motivation for (i) has been elaborated above. I defer discussion of the motivation for (ii) to section 3.3.

This markedness constraint, SONPRES, dominates a faithfulness constraint, IDENT-IO[SON] (McCarthy & Prince 1995):

(3-6) IDENT-IO[SON]: Assign one violation mark for every change in the value of the feature [sonorant] between the input and the output.

(Hereafter, I present this constraint in the abbreviated form IDENT[SON])

The markedness constraint, however, predicts that [-sonorant] segments never appear in between sonorants. As we saw in (2-14), this is not the case: these segments do indeed occur between sonorants word internally. To capture the fact that lenition only targets suffix-initial stops, we need a constraint that prohibits alternations in the root. A simple IDENT-faithfulness constraint allows us to capture this (McCarthy & Prince 1995):<sup>2</sup>

(3-7) IDENT-IO[SON]-ROOT: Assign one violation mark for every change in the value of the feature [sonorant] in the *root* between the input and the output.

(Hereafter, I refer to this constraint in an abbreviated form as IDENT-ROOT)

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<sup>2</sup> The alternative would be to posit a morpheme boundary in the SONPRES constraint. But since the argument is that SONPRES is a *general* constraint, I have chosen not to include the morpheme boundary in its definition.

IDENT-ROOT must necessarily dominate SONPRES, since if not we would expect to see lenition of intersonorant stops root-internally. Hence, we have the following constraint hierarchy:

(3-8) IDENT-ROOT » SONPRES » IDENT[SON]

I illustrate the interaction between these three constraints in tableau (3-9) below with the Djapu word [waṭu + puɟ] ‘dog-ASSOC’. The root internal-stop has lenited to the corresponding semivowel in both candidates (3-9c) and (3-9d). This is a fatal violation of high-ranked IDENT-ROOT. So candidate (3-9d) is ruled out, despite not violating the markedness constraint SONPRES. Candidate (3-9b), with the stop-initial suffix, has two violations of SonPres whereas (3-9a) only violates this constraint once. Therefore (3-9a), with the continuant-initial suffix, is predicted to be the optimal candidate.

(3-9) Illustration of IDENT-ROOT » SONPRES » IDENT[SON]

	/waṭu + puɟ/ ‘dog-ASSOC’	IDENT-ROOT	SONPRES	IDENT[SON]
☛ a.	waṭuwuj		*	*
b.	waṭupuj		**!	
c.	wajupuj	*!	*	
d.	wajuwuj	*!		**

Another potential way in which SONPRES could be satisfied is by deletion of the target segment or by epenthesis of a non-continuant segment – vowel epenthesis would not resolve the issue. Therefore, it is necessary to make a brief account of the faithfulness constraints MAX-IO and DEP-IO-C (McCarthy & Prince 1995). These are defined below:

(3-10) MAX-IO: Assign one violation mark for every segment that is deleted between input and output. [Hereafter MAX]

(3-11) DEP-IO-C: Assign one violation mark for every consonant segment that is inserted between input and output. [Hereafter DEP-C]

Neither of these processes occurs, so it is safe to assume that they are undominated constraints in our hierarchy. It is not possible, however, to form a ranking argument

to determine their relative ranking. Furthermore it is not clear how these other faithfulness constraints should be ranked against IDENT-ROOT. I have not made an attempt at a ranking argument to determine the relative ranking of MAX, DEP-C and IDENT-ROOT. Hence, we have the following constraint hierarchy:

(3-12) MAX, DEP-C, IDENT-ROOT » SONPRES » IDENT[SON]

Tableau (3-13) illustrates the outcome of the constraint hierarchy. In addition to the violations described in (3-9) above, candidate (3-13e) has the target segment deleted, therefore violating MAX.<sup>3</sup> (3-13f), which contains an epenthetic [t], violates DEP-C. As before, (3-13b) violates the markedness constraint more seriously than (3-13a), and (3-13c) and (3-13d) both violate IDENT-ROOT. This leaves us with the optimal candidate, (3-13a).

(3-13) Illustration of Max, Dep-C, Ident-Root » SonPres » Ident[son]

	/ waɬu + puj / 'dog-ASSOC'	MAX-IO	DEP-IO-C	IDENT-ROOT	SONPRES	IDENT[SON]
a.	waɬuwuj				*	*
b.	waɬupuj				**!	
c.	wajupuj			*!	*	*
d.	wajuwuj			*!		**
e.	waɬuØuj	*!			*	
f.	waɬutpuj		*!		*	

I assume for the rest of this paper that MAX and DEP-C are undominated in the hierarchy. So I do not refer to them in subsequent tableaux, except in summary tableaux for the sake of completeness.

### 3.3 THE NASAL QUESTION

The analysis presented in the previous section accounts for the behaviour of suffixes following stops, liquids, semivowels and vowels. It does not, however, account for the fact that lenition does not occur following nasals. Nasals are segments specified as [+sonorant]. As such, we would expect according to this model that suffix-initial stops would lenite following nasal-final roots, but this categorically does not happen.

<sup>3</sup> This candidate would presumably also violate a phonotactic constraint prohibiting vowel hiatus, since word-medial syllables cannot start with a vowel in these languages (see Hamilton 1996).

Our constraint hierarchy would, therefore, predict the wrong outcome as illustrated with the Djapu word /wa:jɪn + ku/ ‘animal-DAT’ in (3-14) below. Candidate (3-14a), the actual attested form, is not optimal due to its violation of highly ranked SONPRES. Neither candidate violates IDENT-ROOT. Therefore, it is predicted that (3-14b), the candidate with the lenited variant, is optimal. This is clearly not the desired outcome.

(3-14) Overapplication of lenition following nasals (Unattested optimal candidate indicated with ☞)

	/wa:jɪn + ku/ ‘animal-DAT’	IDENT-ROOT	SONPRES	IDENT[SON]
☛ a.	wa:jɪnku		*!	
☞ b.	wa:jɪnwu			*

In view of this, it is necessary to introduce a ‘lenition-blocking’ constraint that dominates our ‘lenition-causing’ markedness constraint. I propose a constraint that appeals to the Syllable Contact Law (Murray and Vennemann 1983: 520; cf. Sonority Sequencing Principle: Clements 1990).

(3-15) Syllable Contact Law (SCL): The preference for a syllabic structure  $A\$B$ , where  $A$  and  $B$  are marginal segments and  $a$  and  $b$  are the consonantal strength values of  $A$  and  $B$  respectively, increases with the value of  $b$  minus  $a$ .

Murray and Vennemann (1983) build on the work of Hooper (1976) who observed that syllable boundaries were assigned based on the strength of the contiguous segments. Further, she asserted that there is a preference for a syllable-initial  $C$  to be stronger than the immediately preceding syllable-final  $C$ . The strength of consonants refers to a scale presented below (Murray and Vennemann 1983: 519; cf. Hooper 1976: 206):

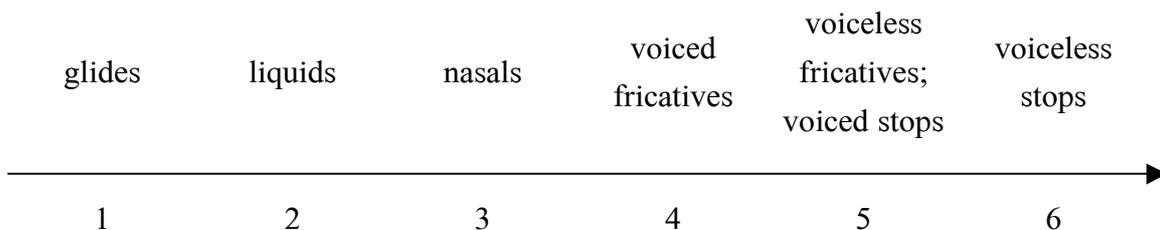


FIGURE 4. Consonant strength scale

This syllable structure condition applies readily to the phonotactics of many Australian languages. Hamilton (1996), in his survey of Australian phonotactics, gives perceptual evidence motivating the unmarkedness of sonorant+obstruent clusters. Specifically he asserts that consonant clusters have a preference for falling sonority. This means that segments with high-sonority, and hence weak strength, are unmarked in  $C_1$ , where  $C_1$  is the first consonant in a heterosyllabic consonant cluster word-internally. However, segments with low sonority, which are on the higher end of the strength scale, are unmarked in syllable-initial  $C_2$  (the second consonant in a heterosyllabic consonant cluster word-internally). Hence, the preference against [-cont][+cont] sequences (see also Baker 2008).

Therefore a constraint referring to SCL is well motivated in an analysis of Yolngu alternations. In Yolngu, semivowels and liquids (and vowels) are grouped as one class for the purposes of a strength hierarchy. I have assigned them an overall strength value of *W(eak)*. Nasals and stops have the overall strength value *S(trong)*. This grouping also corresponds to a natural class distinction between [+continuant] segments with value *W* and [-continuant] segments with value *S*.

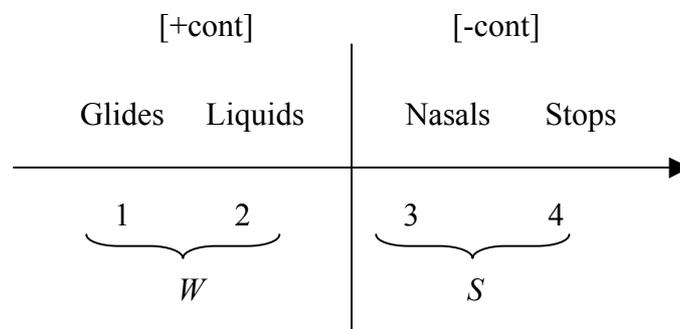


FIGURE 5. Consonant strength scale in Yolngu

The definition given for SCL in (3-15), however, predicts that violations of the constraint are not equally serious. Specifically, Murray and Vennemann (1983) suggest that the violation of the principle is proportional to the degree to which the consonantal strength of *A* exceeds that of *B*. In our data, however, there is no such gradience. Instead, any instance in which the consonantal strength of *A* exceeds that of *B* is a fatal violation. A more restricted constraint is thus needed. I propose a definition of such a constraint in (3-16):

(3-16) 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  $S > W$ ).

This constraint essentially penalises sequences of  $SW$  segments. So a stop that lenites to its corresponding continuant following a nasal violates SCL. Sequences of  $WS$  segments (such as liquid-stop) do not violate SCL. SCL is necessarily ranked above SONPRES since if not it would predict that suffix-initial stops lenite after nasals. Moreover, this phonotactic constraint does not seem to be violated in the lexicon of Yolngu generally as well as in derived forms. This suggests that the phonotactics of complex words obeys the same restrictions as that of roots and enforces uniformity across the lexicon. Thus we avoid the duplication problem (Kenstowicz & Kisseberth 1977).

An illustration of SCL's interaction in the constraint hierarchy is presented in (3-17). Candidate (3-17b), which contains the semivowel variant, does not violate SONPRES but crucially it violates high-ranked SCL. Faithful candidate (3-17a) does not violate SCL. As an outcome, we get (3-17a) as the correct output.

(3-17) Illustration of SCL

	/wa:jin + ku/ 'animal-DAT'	SCL	SONPRES	IDENT[SON]
a.	wa:jinku		*	
b.	wa:jinwu	*!		*

Note also that that SCL must be ranked below MAX and DEP-C. Both deletion of the target segment and epenthesis of an intervening segment are potential ways of not violating SCL. But neither of these processes occurs in Yolngu. I do not make a claim about the relative ranking of SCL and IDENT-ROOT since they do not conflict (however, see chapter 4). Consequently, we have a final constraint hierarchy as follows:

(3-18) MAX, DEP-C, IDENT-ROOT » SCL » SONPRES » IDENT[SON]

I present a summary tableau in (3-19). (3-19d) and (3-19e) violate MAX and DEP-C respectively and are ruled out immediately. Candidate (3-19c) contains a lenited

root-internal segment that violates IDENT-ROOT. It also contains two violations of SCL. (3-19b), the candidate that contains the lenited suffix variant, violates SCL. The optimal candidate is predicted to be candidate (3-19a) even though it has two violations of SONPRES.

(3-19) Summary Tableau – /wuŋkan-ti/ ‘dog-ERG’

	/wuŋkan-ti/ ‘dog-ERG’	MAX-IO	DEP-IO- C	IDENT -ROOT	SCL	SONPRES	IDENT[SON]
a.	wuŋkan̩ti					**!	
b.	wuŋkan̩ji				*!	*	*
c.	wuŋwan̩ji			*!	**		**
d.	wuŋkan̩i	*!				*	
e.	wuŋkan̩ti		*!			*	

This constraint ranking enables us to describe the stop-continuant alternations in Yolngu succinctly and elegantly. Admittedly, the use of Kingston’s original constraint in (3-2), where the lower limits of sonority are specified, would have saved us having to posit SCL. However, this would ignore the fact that SCL is a general phonotactic constraint in the lexicon of Australian Aboriginal languages (see Hamilton 1996). In the analysis presented, with the use of a more general markedness constraint motivating lenition, we are able to capture this descriptive generalisation. The pattern of alternations is thus a tension between two markedness constraints, and not just one.

In the following section, I discuss the distribution of the apical stop and argue that it is unnecessary to posit a constraint that blocks lenition of this particular class of segments.

### 3.4 THE STATUS OF THE APICAL SERIES

Recall that in Yolngu, lenition only targets labial, dorsal and laminal stops. Apical stops categorically do not lenite. In this section, I discuss two potential explanations for this observation: (1) that there is some constraint that prohibits apical stops from leniting or (2) that this pattern falls out directly from the distribution of apical stops in these languages. I show that it is unnecessary to posit a ‘lenition-prohibiting’ constraint which targets the apical series of stops. I argue that this particular

phonological pattern can be explained by distributional and phonotactic patterns alone.

Wood (1978) does not discuss explicitly whether there are apical-stop initial suffixes in Gaalpu. Neither does he suggest why apical stops do not undergo lenition. Other more substantive works on other varieties such as Djapu (Morphy 1983), Djambarrpuyngu (Heath 1980; Wilkinson 1991) and Dhuwaya (Amery 1985), do not account for this fact either. It is clear, however, that the reason for apicals not leniting is the fact that there are no apical-stop-initial suffixes that would be the target of such a rule. Zorc's (1996) pan-Yolngu dictionary confirms this hypothesis, having only one entry for an apical-stop-initial suffix. This is given as /-tu/, an allomorph of the ergative suffix /-tu/ due to phonological assimilation to the place of articulation of the preceding apical segment. Yet this is a marginal example, since it only occurs following alveolar noncontinuants in developmental Dhuwaya (Amery 1985), a children's variety of the language. Since this variant follows nasals, it would not be a target for lenition either.

This distribution pattern is not an accidental fact. In his overview of the phonotactics of Australian languages, Dixon (2009[1980]) makes an important generalisation: "consonants which are most marked, in terms of 'place of articulation' features, tend to occur in syllable-initial position, and the least marked ones syllable-finally" (p.188). In Dixon's view, peripheral segments (ie. labials and dorsals) are the most marked and the least marked are apicals. Following this generalisation, apical stops would be the least frequent segments syllable-initially. Hamilton (1996) presents this observation in two markedness scales:

(3-20) Harmonic scales of place features in  $C_1$  and  $C_2$  where  $C_1$  and  $C_2$  are contiguous word-internal consonants in a heterosyllabic cluster.

$C_1$ : Apical  $\succ$  Laminal  $\succ$  Dorsal  $\succ$  Labial

$C_2$ : Labial  $\succ$  Dorsal  $\succ$  Laminal  $\succ$  Apical

Where " $\succ$ " means 'more harmonic than'

Given these facts, positing an ad hoc constraint that blocks the lenition of apical stops is superfluous. This generalisation falls out directly from distributional patterns and phonotactic restrictions in Yolngu. Apical stops are never the target of lenition

since they do not occur in suffix-initial position, the only position where lenition occurs.<sup>4</sup>

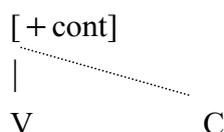
### 3.5 PREVIOUS ANALYSES OF LENITION

Lenition has commonly been conceived of as a specific case of assimilation (see Szigetvári 2008 for counter arguments). Lass, for example, writes: “[k] → [x] context-free, this is simply *spirantisation*; but if the same thing happens between vowels, this can count as assimilation” (1984: 171; emphasis in original). What is clear in this claim is that cases of lenition are commonly cases of assimilation as well (see Bauer 2008 for cases which are not). This being the case, I assume that lenition is a particular case of assimilation. In the following sections, I show how previous phonological analyses of assimilation processes fail to account for the lenition pattern we see in Yolngu.

#### 3.5.1 LENITION IN AUTOSEGMENTAL PHONOLOGY

The Autosegmental Phonology account of assimilation has traditionally involved the spreading of a particular feature from one segment to an adjacent segment, progressively or regressively (Goldsmith 1979). Lenition (specifically the type that we are discussing in this paper: approximation) can thus be analysed as the spreading of the feature [+cont] to an adjacent target segment (eg. Mascaro 1984 on Spanish).

#### (3-21) Lenition as feature spreading



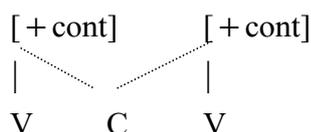
There are, however, a number of problems with such an approach. Importantly for this paper, feature spreading can only account for the role of one flanking segment in conditioning lenition (see also Kirchner 1998; 2001). This problem is of central concern to our discussion of the alternations in Yolngu. As I presented above, lenition in Yolngu is conditioned by both the preceding context *and* the following context. We saw diachronic evidence for this analysis. An Autosegmental Phonology

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<sup>4</sup> Butcher (2008) notes that apical stops are the least likely to lenite. However, he suggests that intervocalic apical stops frequently become taps or flaps due to the lack of intraoral pressure.

analysis of this pattern therefore cannot capture the fact that *both* flanking segments are necessary for triggering lenition. It can only account for the role of one side of the target in conditioning the alternation. But as Szigetvári (2008) asserts regarding intersonorant voicing assimilation, intersonorant lenition is unique since “it requires there to be a trigger on both sides of the target” (p.105).

### (3-22) Lenition as feature spreading



Moreover, if canonical examples of lenition occur *between* continuants or vowels, as Lavoie (2001) asserts, then Autosegmental Phonology is thus incapable of explaining the most common examples. Lavoie (2001) argues that while word-final alternations are often thought of as lenition, they are better explained by the Coda Condition (Ito 1988). Feature spreading predicts that lenition triggered unilaterally should be more common, in fact, than lenition triggered bilaterally by a two-sided context. But as Lavoie (2001) suggests, lenition triggered by *both* flanking segments is more common and, indeed, more typical. And as we have seen in Yolngu, lenition only occurred historically *between* non-nasal sonorants. So the fatal weakness of a feature spreading model of lenition is that it cannot explain the role of the following segment in intersonorant lenition, implying that the following context is redundant when it is, in fact, crucial to the triggering of the change.

### 3.5.2 OT ACCOUNTS: AGAINST LOCAL AGREE

Classic OT accounts of assimilation processes build very much on the insights of Autosegmental Phonology discussed in the previous section. Correspondingly, they have been similarly problematic. A number of constraints have been proposed to account for assimilation processes, namely AGREE, ALIGN and McCarthy’s (2004) Spans theory. Below, I discuss the limitations of local AGREE in relation to analysing lenition. While there are important differences between the different analyses, these are not pertinent to our discussion.

Local AGREE (Bakovic 2000) requires that adjacent segments have the same value for a given feature. If a segment has a feature value  $[\alpha F]$  then the segment immediately preceding or following it must also bear the feature value  $[\alpha F]$ . For example, sequences such as  $[-cont][+cont]$  would violate AGREE. However, if

lenition is crucially triggered by *both* sides of target segment, then AGREE is incapable of explaining the role of one flanking segment – it can only refer to one adjacent segment.

So far I have argued that in Yolngu, both the preceding [+son] segment and the following vowel, also a [+son] segment, play a role in conditioning the alternation patterns we see. If we are pursuing such an analysis, a satisfactory account must be able to explain the two-sided context. Like feature spreading in Autosegmental Phonology, AGREE is only capable of describing the role of one flanking segment and therefore does not provide an insightful analysis of the pattern in Yolngu. If canonical cases of lenition occur between sonorants, then analyses that can only explain the role of one flanking segment make the wrong predictions.

### 3.6 CONTINUANT VS. SONORANT

Kingston’s original proposal used the feature [continuant] in the formulation of the “lenition-causing” markedness constraint. In my analysis, I have utilised the feature [sonorant] instead. In the following sections, I show that an analysis using the feature [continuant] makes the wrong predictions for the alternation patterns I have discussed in this paper. Specifically I show that using [continuant] would predict that nasals lenite when they do not. I also discuss the problems associated with an analysis of the glottal stop and propose a tentative solution. The relevant constraints to which I will be referring in the following sections are:

(3-23) \*[-CONTINUANT] / L\_V from (3-2)

(3-24) IDENT-IO[CONTINUANT]: Assign one violation mark for every change in the value of the feature [continuant] between the input and the output.

(Hereafter Ident[continuant])

The corresponding constraint hierarchy is:

(3-25) Constraint ranking

\*[-CONTINUANT]/L\_V » IDENT[CONTINUANT]

I will not refer to other faithfulness constraints, such as IDENT-ROOT and MAX, presented above, since they are not crucial.

### 3.6.1 THE NASAL-SUFFIX PROBLEM

In our analysis so far, we have only considered the behaviour of oral stop-initial suffixes. While Wood (1978) does not explicitly discuss other suffixes in Gaalpu, Morphy (1983) and descriptions of other Yolngu varieties show nasal-initial suffixes in nominal and verbal paradigms (eg. Djambarrpuyngu, Wilkinson 1991; Heath 1980; Dhuwaya, Amery 1985). These nasal-initial suffixes present a problem for an analysis using the constraint hierarchy in (3-25).

Nasals are segments specified as [-continuant] since they are characterised as having a closure in the vocal tract. Therefore, surface forms of nasal-suffixes in the environments in which lenition is expected would violate \*[-CONTINUANT]/L\_V. An illustration of this is presented in (3-26) below with the Gaalpu word /puɿwu-ɳa/ ‘flower-ACC’:

(3-26) Lenition of suffix-initial nasal (Unattested optimal candidate indicated by ☹)

	/puɿwu + ɳa/ ‘flower-ACC’	*[-CONTINUANT]/L_V	IDENT[CONTINUANT]
☹a.	puɿwuɳa	*!	
☺b.	puɿwuŋa		*

The constraint \*[-CONTINUANT]/L\_V prohibits [-continuant] segments from appearing between [+continuant] segments. Therefore the constraint ranking predicts that candidate (3-26b) with a nasalised glide (a potential lenited form) would be the optimal output. The actual attested candidate, (3-26a), violates the high-ranked \*[-CONTINUANT]/L\_V. So the markedness constraint using the feature [continuant] favours the wrong candidate and makes the wrong predictions.

Using the feature [sonorant] remedies this situation.<sup>5</sup> By applying the constraint ranking in (3-18), we are able to capture the generalisation that nasals do not lenite. But as we see in (3-27) with the relevant section of the constraint hierarchy, a tie results, since no candidate is favoured by a higher ranked constraint.

<sup>5</sup> The alternative solution which could allow this analysis to work is to posit a universal markedness constraint against the lenition of nasals. Kingston (2008), following Steriade (1993), suggests that the failure of stops to lenite following nasals can be explained in articulatory terms. I refer the reader to Kingston (2008) and Steriade (1993) for a discussion of this.

(3-27) Tie in candidates

	/ puɽwu + na /	SONPRES	IDENT[SON]
? a.	puɽwuna		
? b.	puɽwɨja		

Therefore, we are forced to retain the constraint IDENT[CONTINUANT] to break the tie between candidates. This not a problem for an OT framework since constraints in CON are considered universal and every language will have the same set of constraints, just with different rankings. Presumably then, this constraint is low-ranked, since it is not needed in the other interactions shown so far. It must necessarily be ranked below SONPRES, if not we predict that lenition is categorically blocked from occurring. Since stops never spirantize, it suggests that IDENT[CONTINUANT] is ranked below IDENT[SON], because fricatives satisfy the latter. An illustration of this hierarchy is shown in Tableau (3-28):

(3-28) Correct output using SONPRES

	/ puɽwu + na /	SONPRES	IDENT[SON]	IDENT[CONTINUANT]
• a.	puɽwuna			
b.	puɽwɨja			*!

### 3.7 THE GLOTTAL STOP

The phonological status of the glottal stop in Yolngu is an open question. According to Wood (1978) and Morphy (1983), the glottal stop is not phonemic, but is rather a prosodic feature. In other Yolngu varieties such as Djambarrbuyngu (Wilkinson 1991; Heath 1980) and Ritharrngu (Heath 1980), the glottal stop has been analysed as a phonemic segment. Similarly, in neighbouring languages, a similar disagreement holds, with Baker (2008) arguing for a segmental analysis in Ngalakgan and McKay (1975) arguing for a prosodic one in Rembarrnga.

What is clear is that the glottal stop in Yolngu is at least phonemically contrastive since we can establish minimal pairs, such as the following:

Djambarrpuyngu

(3-29) kuɽkuʔ            ‘fish’

(3-30) kuɽku            ‘many, lots’

- (3-31) warʔju            ‘take out’  
 (3-32) warju            ‘push/pull’
- (3-33) cawarʔju        ‘to spear, stab, pierce’  
 (3-34) cawarju        ‘to be tired, bored’

The first observation is that the distribution of the glottal stop is highly restricted. It only occurs in syllable-final position and it can only follow a liquid, semivowel, nasal or vowel, that is, the class of sonorants (see Morphy 1983: 24; see also Baker 2008 on Ngalakgan). Furthermore, the occurrence of the glottal stop is further restricted since words can contain a maximum of one glottal stop. In the event that more than one glottal stop appears in a complex word, a deletion rule ensures that all but the first glottal stop in the word are deleted.

- (3-35) /ʔ/        →        Ø        / #...ʔ/... \_\_\_\_...# (Baker 2008: 279)<sup>6</sup>

Finally, the glottal stop also does not occur in intervocalic position, the position where we expect most, if not all, segments to be contrastive.

Morphy (1983) and Wood (1978) argue against a phonemic analysis based on the fact that including the glottal stop in the phonemic inventory would set up a CVCCC syllable type where the final C can only be a glottal stop. This is in fact what Wilkinson (1991) proposes for Djambarrpuynu. Against the segmental analysis, Morphy (1983) and Wood (1978) argue for a prosodic one, following McKay (1975) on Rembarrnga Wood (1978) specifically contends that the phonetic glottal stop occurs in syllable-final position in lexically specified fortis syllables, calling this the *prosodic syllable feature* (represented as grave accent). This fortis/lenis syllable distinction is therefore the basis for the contrast we see in the following set of words:

- (3-36) /ɬàrjun/        →        [ɬarʔjun]        ‘to throw (plural items)’  
 (3-37) /ɬarjun/        →        [ɬarjun]        ‘to pour (water, gravel)’

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<sup>6</sup> This is a modified rule from Wilkinson (1991: 85). Here an ellipsis has been added before the final word boundary which is more closely accords with Wilkinson's description.

- (3-38) /palà/ → [palaʔ] ‘house, building’  
 (3-39) /pala/ → [pala] ‘direction away’

Yet this analysis, as Evans (1995) argues, fails to account for the segmental-like contrast with other phonemes.

Interestingly, the presence of a glottal stop root-finally has no bearing on the stop-continuant alternations in Yolngu.<sup>7</sup> As Wilkinson (1991) points out for Djambarrpuyngu, the conditioning segment for the alternation is not the glottal stop but the non-string adjacent segment preceding it. This is an instance of lenition conditioned by non-local factors, which is rare.<sup>8</sup> Therefore, we get the same kinds of alternations with or without the syllable-final glottal stop as shown below:

- (3-40) ku[kuʔ-ju] fish-ERG  
 (3-41) ku[ku-ju] many-ERG  
 (3-42) warakanʔ-ku animal-DAT  
 (3-43) ɲaŋan-ku paper-bark-DAT

Evidently, whatever position one adopts to analyse the phonological status of the glottal stop, it is necessary to account for its transparency in the phonological processes dealt with in this paper. In what follows, I propose that the glottal stop should be analysed as a segment, following Baker (2008). I argue for a tentative representation of the glottal stop that explains to a great degree its behaviour with regards to the stop-semivowel alternations we see in Yolngu.

### 3.7.1 ANALYSING THE GLOTTAL STOP

The glottal stop has traditionally been specified as having the feature [-continuant] (eg. Chomsky and Halle 1968). Specifying the glottal stop for this feature, however, would ensure that suffixes would consistently be realised as stop-initial following a glottal-final stem; continuant-initial candidates would violate high-ranked SCL. Suffixes will be realised as stop-initial following a glottal stop specified for [-cont]

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<sup>7</sup> Whether or not this is also the case in Gaalpu is unclear. Wood (1978) does not discuss this specific pattern. Due to the similarities between the Yolngu varieties considered in this paper, however, I will assume that the same pattern exists in Gaalpu as in the other varieties.

<sup>8</sup> A common example of a phonological process conditioned by non-local factors (ie. long-distance processes) is vowel harmony (see for example van der Hulst & van de Weijer 1995).

regardless of its specification for the feature [sonorant]. Therefore the constraint hierarchy in (3-18) does not generalise easily to an analysis of the behaviour of the glottal stop. An illustration of this problem is shown in (3-44), assuming that the glottal stop is specified as [+son].

(3-44) Glottal stop with specification [+son, -cont] (Unattested optimal candidate indicated with ☹): Lenition is always blocked.

	/palaʔ + puj/ 'house-ASSOC'	SCL	SONPRES	IDENT[SON]
☹ a.	palaʔwuj	*!		*
☺ b.	palaʔpuj		*	

Due to the glottal stop's specification of [-cont], lenition would be blocked consistently to satisfy high-ranked SCL, since [ʔ] is classified as a 'strong' margin. Therefore, the sequence [-ʔw-] causes candidate (3-44a) to be a losing candidate. Candidate (3-44b), containing the stop variant, is the resulting optimal candidate since it does not violate SCL. Specifying the glottal stop as [-cont] simply means that lenition will be blocked categorically following it, regardless of its specification for [sonorant]. As we have seen, this is not the case and lenition does indeed occur following glottal stop-final roots.

How then are we to account for this behaviour? As we have seen, a specification of [-cont] is highly problematic, no matter the specification for [sonorant]. Here, I consider the alternative: that the glottal stop is specified as [+cont]. This certainly means that the glottal-final roots will never violate SCL. There are therefore two possibilities to consider in terms of feature specifications:

(3-45) [+cont, +son]

(3-46) [+cont, -son]

It seems, however, that whichever option we choose to adopt, we inadvertently run into trouble with our analysis. If the glottal stop is specified as [+son] (eg. Halle and Clements 1983), the prediction would be that lenition occurs consistently after glottal-final roots in order to satisfy SONPRES. This prediction is shown in (3-47) below:

(3-47) Glottal stop with specification [+son, +cont] (Unattested optimal candidate indicated with ☹): Lenition is always triggered.

	/jawariŋʔ + ku/ 'adolescent men-DAT'	SCL	SONPRES	IDENT[SON]
☹a.	jawariŋʔku		*!	
☺b.	jawariŋʔwu			*

(3-47b) does not violate SONPRES and thus is wrongly predicted to be the optimal candidate. (3-47a), the attested candidate, fails since it violates SONPRES. Neither candidate violates SCL. But as we have seen, lenition does not occur following glottal stop-final roots with preceding nasals, as in (3-42).

Alternatively, if we specify the glottal stop as [-son], as Gussenhoven and Jacobs (2005) suggest, the alternation would never occur after glottal-final roots since the environment that conditions SONPRES will never be met. But as I have shown, lenition does occur after glottal-final roots with preceding non-nasal sonorants. This problem is exemplified below:

(3-48) Glottal stop with specification [-son, +cont] (Unattested optimal candidate indicated with ☹): Lenition is never triggered.

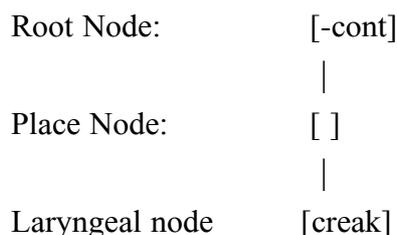
	/palaʔ + puj/ 'adolescent men-DAT'	SCL	SONPRES	IDENT[SON]
☹a.	palaʔwuj			*!
☺b.	palaʔpuj			

(3-48a), the attested candidate, violates IDENT[SON], therefore the faithful candidate (3-48b) is wrongly predicted to be optimal since it does not violate any constraints. Clearly, an analysis that specifies the glottal stop for the features [sonorant] *and* [continuant] will fail to give us the correct predictions about its behaviour (or lack thereof) in the lenition process. The different feature specifications I have considered cannot account for the fact that both variants can occur following glottal stop-final roots and what conditions the alternation is the segment that precedes the glottal stop. Any analysis of the glottal stop must be able to account for its transparent nature in relation to continuant-stop alternations.

Baker (2008) proposes one possible way to analyse the glottal stop in the Northern languages. In neighbouring Ngalakgan, Baker notes that the glottal stop is realised as creaky voice on the preceding consonant and vowel. Crucially, the distribution of the

glottal stop in Ngalakgan is similar to that seen in the Yolngu languages – it cannot occur following a nonsonorant (ie. a stop) and must be in coda position. Baker argues that the glottal stop is coarticulated with the preceding sonorant due to its zero place specification. That is, he adopts a representation wherein the glottal stop has no place node and only a root node with the specification [-cont] and a laryngeal node specified for the monovalent feature [creak].

(3-49) Glottal stop

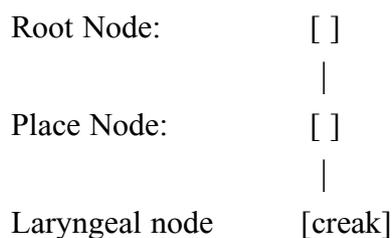


(From Baker 2008: 57)

As it stands, however, Baker’s representation makes the wrong predictions in our analysis. We have already seen that specifying the feature [-cont] for the glottal stop ensures that lenition will never occur since the lenited candidate would violate high-ranked SCL.

Admittedly, the analysis of lenition in Yolngu that I have argued for does not generalise straightforwardly to an account of the behaviour of the glottal stop. The problems discussed above raise the question of whether it is at all necessary for us to specify those features, [continuant] and [sonorant], in the first place. Indeed, Harvey (1991) argues that the behaviour of the glottal stop in phonological processes can be accounted for if we adopt a radical underspecification approach in languages like Yolngu. Following Baker (2008), the glottal stop can be analysed as creaky voice. I suggest that it can be represented as an autosegment that is specified solely for the monovalent feature [creak].

(3-50) Glottal stop



Adopting such an analysis would mean that the glottal stops in Yolngu and other Northern languages, such as Rembarrnga, are different kinds of segments from those we see in German or English, which are characterised by full closure of the vocal folds (Gordon & Ladefoged 2001). Here, they merely constitute coarticulated creaky voice realised on a preceding sonorant (see also Baker 2008). In fact, Ladefoged and Maddieson (1996) suggest that phonemic glottal stops are often realised as creaky phonation on neighbouring segments, rather than the more typical full glottal closure. Since glottal stops do not have a root node, they must completely assimilate to the root node of the preceding segment. By adopting this analysis, the fact that the glottal stops are necessarily transparent to the process of lenition follows.

The treatment of the glottal stop, to be sure, is still an open question. The analysis I have presented has not been tested empirically and indeed more phonetic investigation needs to be conducted into how the glottal stop is realised in Yolngu. That being said, Wood (1978) provides us with an anecdote that suggests the analysis presented here might be on the right track. Wood relates a discussion with a Yolngu friend in which the distinction between “*ʔa:l*” (strong, hard) and “*ʔalŋki*” (soft, weak) is made. Wood and his informant discussed the minimal pair [ʔarʔjun] ‘to throw’ and [ʔarjun] ‘to pour’, where the first was described as [ʔa:l] ‘strong’, and the second was described as [ʔalŋki] ‘weak’. Wood goes on to describe this as a form of “tensing” (p. 98). Of course, this is not enough to conclude that the analysis presented here is correct, but it does suggest that perhaps the glottal stop is made with an active tensing of the vocal folds, characteristic of creaky voice (Gordon & Ladefoged 2001). Whatever the case, a satisfactory analysis of the glottal stop’s behaviour in Yolngu needs to be able to explain its transparency in the lenition process – it plays no role at all in conditioning the suffix alternations that have been the central concern of this paper.

## CHAPTER 4. SEGMENTAL HARDENING IN WUBUY

In the preceding chapter, I presented an analysis of lenition in Yolngu. Specifically, I argued that a proposal, following Kingston (2008), along with SCL captured the generalisations in the data succinctly and elegantly. In this chapter, I extend the analysis in discussing an alternation pattern in Wubuy (a.k.a. Nunggubuyu, Heath 1984) that has hitherto been analysed as a case of segmental hardening. I show that the exact same constraints are capable of accounting for the descriptive generalisation about continuant-stop alternations in Wubuy.

### 4.1 HARDENING IN WUBUY

Wubuy, like the Yolngu languages I have discussed above, evinces a set of alternating continuants and obstruents at morpheme boundaries. The correspondences are shown below:

[+cont]		[-cont]
A		B
w <sub>2</sub>	↔	p
ɺ	↔	t̪
r	↔	t
ɻ	↔	t̪
j	↔	c
w <sub>1</sub>	↔	k

TABLE 4. Wubuy consonant alternations, following Heath 1984

There are a number of immediate differences between the alternation pattern in Wubuy and in Yolngu. Firstly, Heath (1984) analysed this pattern as a case of hardening, with the semivowels underlying and the stops derived by a phonological rule:

$$(4-1) \quad A \rightarrow B / [-\text{cont}] + \_\_\_ \quad (\text{modified from Heath 1984: 62})$$

Where *A* represents segments in the left column in Table 4 and *B* those in the right.

He argues that while historically the stops were underlying, synchronically it is the continuant variants that are underlying, implying that there was a historical lenition

of obstruents to continuants (see also Baker 2009). Evidence for this analysis of synchronic directionality is a set of roots that are realised consistently with a stop. Heath (1984) argues that if the stop-initial variant were underlying, we would need to posit two sets of stops: one that regularly undergoes alternation and one that does not.<sup>1</sup> Moreover, the continuant surfaces word-initially in citation form, meaning that some lenition rule would be needed to account for the appearance of word-initial continuants. The following examples show the alternation pattern in suffixes (4-2 to 4-4) and roots (4-5 to 4-8):

Alternations in suffixes

- |       |              |   |                          |                |
|-------|--------------|---|--------------------------|----------------|
| (4-2) | m̩aɬalak-ruc | → | m̩aɬalaktuc <sup>2</sup> | ‘at the beach’ |
| (4-3) | a-ɭaɬɬ-ruc   | → | ɭaɬaɬtuc                 | ‘on the chin’  |
| (4-4) | a-ɭakuɭa-ruc | → | ɭakuɭaruc                | ‘on the lip’   |

Alternations in roots

- |       |                        |   |                      |                                 |
|-------|------------------------|---|----------------------|---------------------------------|
| (4-5) | ŋa-w <sub>2</sub> aŋ   | → | ŋaw <sub>2</sub> aŋ  | ‘I bit it (NEUT class)’         |
| (4-6) | nun-w <sub>2</sub> aŋ  | → | nunpaŋ               | ‘you bit it (NEUT class thing)’ |
| (4-7) | ŋa-w <sub>2</sub> ini  | → | ŋaw <sub>2</sub> ini | ‘I hit it’                      |
| (4-8) | ŋam-w <sub>2</sub> ini | → | ŋampini              | ‘I would have hit it’           |

Secondly, the correspondences are also slightly different. Whereas in Yolngu both lamino-dental and lamino-palatal stops were paired with the palatal glide, in Wubuy only the lamino-palatal stop is paired with the palatal glide. The corresponding continuant for the lamino-dental stop is a lamino-dental lateral, which does not exist in Yolngu. Furthermore, the apical series does show an alternation with the apico-alveolar stop paired with a homorganic tap and the retroflex stop with a homorganic semivowel. This is unlike Yolngu where the alternation only occurs in the peripheral and laminal series, and not in the apical series. In section 3.4, I showed that this was epiphenomenal, since there are just no apical stops that appear in the context in which lenition occurs.

Thirdly, Wubuy is a prefixing and suffixing language, unlike Yolngu. Wubuy maintains the contrast between stops and continuants word-initially and within mor-

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<sup>1</sup> Admittedly, the present analysis assumes two different underlying /w/ segments. This is an issue of abstractness. It seems that whatever position we take comes at some disadvantage.

<sup>2</sup> There is a /k/ deletion rule that deletes the root-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. So the surface form of (4-2) is actually [m̩aɬalatuc].

phemes. The contrast in suffixes, however, is neutralised as in Yolngu, since there are no non-alternating stop-initial suffixes. Continuant-initial roots also show an alternation in the relevant environments. This, however, is complicated by the fact that there is a set of stop-initial roots that do not show any alternations.

Differences aside, the crucial similarity between the alternations in Yolngu and Wubuy is that the conditioning environment for the stop variants and the continuant variants are the same. The stop variants surface following a stop or nasal, and the continuant variants appear following a semivowel, liquid or vowel. The following table summarises the distribution of stop-initial and continuant-initial suffixes in both languages:

Environments	Wubuy	Yolngu	
	Allative-Dative: -w <sub>1</sub> uj	Associative: -puj	
Following semivowels, liquids and vowels	UR: -w <sub>1</sub> uj	Lenited: -wuj	Continuant-variant: SONPRES
Following stops, nasals	Hardened: -kuj	UR: -puj	Stop-variant: SCL

TABLE 5. Surface form correspondences between Wubuy and Yolngu

It is evident that the suffix variants have the same distribution in both languages; this is despite the way in which the processes that derive them are described. Therefore, positing a separate constraint hierarchy for these two alternations would miss this important generalisation. In the following section I lay out a proposal for an analysis, using the constraint hierarchy discussed above, which is capable of capturing all these facts concisely.

#### 4.2 APPLICATION OF THE CONSTRAINT HIERARCHY

Recall the constraint hierarchy presented in (3-18), repeated as (4-9) here:

(4-9) MAX, DEP-C, IDENT-ROOT » SCL » SONPRES » IDENT[SON]

Tableau (4-10) shows how (4-9) allows us to predict the correct outcome for the hardening pattern. In (4-10), (4-10b) is the faithful candidate, but it violates high-

ranked SCL, since it contains the sequence [-*pr*]. Therefore, (4-10a) is the optimal candidate despite its violation of both SONPRES and IDENT[SON].

(4-10) Hardening of underlying continuant following root-final stop

	a- <i>laap</i> - <i>ruc</i> ‘on the chin’	SCL	SONPRES	IDENT[SON]
☛ a.	a <sub>l</sub> aap <sub>t</sub> uc		*	*
b.	a <sub>l</sub> aap <sub>r</sub> uc	*!		

The constraint hierarchy also predicts the correct outcome for the faithful candidate, in which hardening does not occur. (4-11) is an illustration of this. (4-11a) is the faithful candidate, containing the continuant variant. It is easily selected as the optimal candidate since it violates SONPRES just once whereas (4-11b) has two violations of SONPRES and one violation of IDENT[SON].

(4-11) No hardening following a vowel

	a- <i>laku</i>   <i>a-ruc</i> ‘on the lip’	SCL	SONPRES	IDENT[SON]
☛ a.	a <sub>l</sub> aku aruc		*	
b.	a <sub>l</sub> aku atuc		**!	*

(4-10) and (4-11) show that the posited constraint hierarchy makes the correct predictions for output forms, even though the continuant is posited to be underlying. Yet one observation should be noted. The constraint SONPRES is not strictly speaking crucial in explaining the hardening pattern in Wubuy. Admittedly, a constraint hierarchy such as SCL » IDENT[SON] is sufficient. But as such, we would miss the generalisation that the patterns in both Yolngu and Wubuy pattern similarly on the surface. That is, stop variants occur after [-cont] segments and continuant variants occur after [+cont] segments. The analysis argued for here makes the claim that while the underlying representation is different, the similarity of distribution, regardless of directionality of change, is as a result of the same markedness constraints active in the language. The tableaux above have shown this.

Recall that in the previous section, I did not form ranking argument for the relative ranking of SCL and IDENT-ROOT. Here, it is clear that IDENT-ROOT needs to be ranked below SCL in order for us to get the correct output – the hardening of continuant-initial roots in the relevant environments. Moreover, SCL is never violated in the lexicon which suggests that it is undominated. At the same time, IDENT-ROOT needs to be ranked above SONPRES as we saw in the previous section (see section

3.2). (4-12) illustrates the correct output with SCL dominating IDENT-ROOT. (4-12b) violates high-ranked SCL. (4-12a), on the hand, does not, and is the optimal candidate despite violating IDENT-ROOT.

(4-12) Root-initial hardening: the correct output

	ŋam-w <sub>2</sub> ini 'I would have hit it'	SCL	IDENT-ROOT	SONPRES	IDENT[SON]
☛ a.	ŋampini		*	*	*
b.	ŋamwini	*!			

We are able also to capture the fact that some roots surface with initial stop all the time. (4-13) is an exemplification of this with a stop-initial root /cura/ 'to push'. Neither candidate violates SCL. But (4-13b) violates IDENT-ROOT which is ranked above both SONPRES and IDENT[SON]. Therefore, the optimal candidate is the faithful (4-13a), retaining the stop root-initially.

(4-13) Non-leniting stop-initial root

	ŋa-cura 'I push'	SCL	IDENT-ROOT	SONPRES	IDENT[SON]
☛ a.	ŋacura			*	
b.	ŋajura		*!		*

What is clear, then, is that SCL is a high-ranked constraint in this language (and in Yolngu). The phonotactics of complex words conforms to that of the lexicon as a whole.

Evidence to further support SCL as a high-ranked constraint can be found in a separate but related process described by Amery (1985) in Dhuwaya, a koiné variety of Yolngu. Amery states that the allative suffix in Dhuwaya, /-ji/, homophonous with the ergative and instrumental suffixes, was derived from the historical lenition of a lateral segment morpheme-initially. The relevant cognates are presented below (from Amery 1985: 43):

(4-14) Dhuwaya	/-ji/~/-ṭi/	vs.	Dhuwala	/-lili/
			Dhay'yi	/-li/
			Dhuwal	/-li/
			Dhangu	/-li/
			Djangu	/-l(i)/
			Ritharrngu	/-li?/

Amery (1985) argues that lenition of the suffix-initial lateral resulted in the /-ji/ allomorph. However, the allomorph /-ṭi/ emerged following [-continuant] segments, thereby regularising this alternation to conform to the consistent alternation pattern of the other suffixes. This instance, therefore, further argues for the high-ranking of SCL in the grammar.

## CHAPTER 5. RESIDUAL ISSUES

In the preceding chapters, I presented an analysis of lenition in Yolngu and showed how such an analysis could be extended to account for the alternation pattern in Wubuy. In this chapter, I discuss some residual issues with the existing analysis. I discuss a pattern of variation in suffix realisation and the probable historical origins of this. Secondly, I highlight one major difficulty faced by the analysis: that is, it fails to account for final vowel deletion in –CV suffixes, a reflex of the Dhuwal/Dhuwala distinction.

### 5.1 VARIATION IN SUFFIX REALISATION

In section 2.3.1, I suggested that the stop contrast was eliminated from the surface in the Yolngu varieties that are being considered. This means that in suffix-initial position, stops do not contrast. In this section, I revisit this idea and show that this is a problematic assumption. Specifically, this assumption would hold only if all suffixes showed alternations between underlying stops and continuants regularly. However, this is not always the case, and there is a degree of variation in suffix realisation.

In Djambarrpuyngu and Djapu (Dhuwal varieties), there are a number of suffixes whose realisation in post-continuant position is variable. In this position, the predicted realisation of the suffix is with an initial continuant. Instead, both Wilkinson (1991) and Morphy (1983) note stop-initial realisations in this position. The following table modified from Wilkinson (1991) illustrates exactly this pattern, with the relevant suffixes shaded in grey:

Suffix/ Environment	Following stops and nasals	Following liquids	Following semi-vowels	Following vowels
ERG/INSTR	-tu	-ju	-ju	-j
DAT	-ku	-wu	-wu	-w
OR	-kuŋ(u-)	-wuŋ(u-)	-kuŋ(u-)~ -wuŋ(u-)	-wuŋ(u-)
OBL	-kal	-wal~-kal	-wal~-kal	-wal
OBLS	-kalaŋa/u-	-walaŋa/u-	-walaŋa/u-	-walaŋa/u-
PERL	-kur	-kur~-wur	-kur~-wur	-kur~-wur
ASSOC	-puj	-puj~-wuj	-puj~-wuj	-wuj~-puj

TABLE 6. Variation: suffix realisation in Djambarrpuyngu (Wilkinson 1991)

What is clear is that the continuant variant of a suffix never appears following root-final stops or nasals, suggesting a high-ranked constraint that prohibits such clusters (ie. SCL). There is no variation following stops and nasals. Variation only occurs following continuant-final roots.

Heath (1980) presents a more complex picture of variation in suffix alternations in Dhuwal.<sup>1</sup> Firstly, he maintains that the stop contrast is active on the surface and in suffix-initial position, contrary to what Wilkinson (1991) asserts. In his analysis, the associative suffix /-puj/ and the perlativ suffix /-kur/ are underlyingly fortis-stop initial. However, fortis stops neutralise following stops, nasals and glottal stops. So following stop and nasal-final roots, these two suffixes surface with initial neutralised stops. Heath (1980: 8) presents the rule as follows:

(5-1) “Postconsonantal lenition”

$$\begin{array}{l} \text{Stop} \\ [+ \text{fortis}] \end{array} \rightarrow \begin{array}{l} [-\text{fortis}] \\ / \end{array} \left\{ \begin{array}{l} \text{Stop} \\ \text{Nasal} \\ ? \end{array} \right\} - \text{_____}$$

Suffixes like /-p\*uj/ and /-k\*ur/ begin in a fortis stop after root-final vowel or non-nasal sonorant. Heath (1980) further suggests that these same suffixes show a “sporadic and somewhat irregular” (p. 8) pattern of lenition to a continuant. Crucially, this only occurs following root-final vowels or non-nasal sonorants. Therefore, in suffix-initial position, we get a potential three-way alternation, /-p\*uj/~/-puj/~/-wuj/.

<sup>1</sup> Heath (1980) describes both Djapu and Djambarrpuyngu.

Djapu evinces the same kind of variation, especially with the associative and perla-  
 tive suffixes. Table 7 below shows the range of alternations (relevant suffixes are  
 shaded in grey):

Suffix/ Environment	Following stops and nasals	Following liquids	Following semi- vowels	Following vowels
ERG/INSTR	-tu	-ju	-tu~-ju	-j
DAT	-ku	-wu	-ku~-wu	-w(a) <sup>2</sup>
OR	-kuŋ(u-)	-wuŋ(u-)	-wuŋ(u-)	-wuŋ(u-)
OBL	-kal	-wal	-wal	-wal
OBSL	-kalaŋu	-walaŋu-	-walaŋu-	-walaŋu-
PERL	-kur	-kur	-kur	-kur~-wur
ASSOC	-puj	-wuj~-puj	-wuj~-puj	-wuj~-puj

TABLE 7. Variation: suffix realisation in Djapu (Morphy 1983)

In Djapu, the perla-  
 tive /-kur/ suffix does not even occur with suffix-initial continuant  
 following liquids and semivowels. It only occurs with initial continuant following  
 vowels. Morphy (1983) argues that this variation in the realisation of some suffix  
 forms is due to the fact that the phonological system is in transition from one with a  
 fortis/lenis stop contrast in suffix-initial position to one without a contrast. As dis-  
 cussed above, historical lenition eliminated the contrast between stops morpheme-  
 internally in intercontinuant position, except in the case of the apical series. The  
 intercontinuant position was historically the only position in which the fortis/lenis  
 stop contrast was active. Morphy (1983) argues that the stop contrast is also being  
 eliminated in suffix-initial position. She suggests that in Djapu these suffixes some-  
 times regularise to conform to the regular system of morphophonemic alternations;  
 so the change is brought about by analogy.

This explanation is directly amenable to an account of the variation in Djam-  
 barrpuyngu. Fortis stop-initial suffixes such as associative /-p\*uj/ neutralise follow-  
 ing stops and nasals to /-puj/. These morphemes are then reinterpreted as behaving  
 regularly like other alternating suffixes in the language. By analogy, the suffix-initial  
 fortis stop, which occurs following continuants, lenites to a corresponding continu-  
 ant, resulting in the form /-wuj/. The variation we observe is indicative of a phono-  
 logical system in flux, a system that is regularising its morphophonemic alternation

<sup>2</sup> Morphy (1983) suggests that this is an isolated survival from an older case-marker /\*-ba/. The extent  
 to which this is used, however, is unclear.

patterns.<sup>3</sup> Accepting a generalised assumption about the status of the stop contrast is thus problematic, since it ignores this process of language change. This poses interesting challenges for any synchronic analysis.

### 5.1.1 PROBLEMS WITH AN IMPLICATIONAL HIERARCHY

One important observation from Tables 6 and 7 is that there is occasionally variation following semivowels but not liquids. So far, I have pursued an analysis following Kingston (2008) wherein the sonority of flanking segments is predicted to affect the likelihood of segments to lenite. Kingston’s original proposal uses the constraint in (3-2) reproduced as (5-3) below:

- (5-2) \*[-CONTINUANT]/L\_V: Assign one violation mark for every segment specified as [-continuant] that occurs following any segment as or more sonorous than a liquid and before a vowel.

This is based on the sonority hierarchy. Based on this hierarchy, the implication is that if lenition occurs following a liquid, it should lenite following anything more sonorous than it, ie. semivowels and vowels. However, in Tables 6 and 7 above, this prediction is contradicted, since we have instances of categorical lenition following liquids, but variable lenition following semivowels.

#### Djapu

- (5-3) wakuj-ku~wakuj-wu            ‘armpit-DAT’  
 (5-4) kalaj-tu~ kalaj-ju            ‘MMBD’s child-ERG’<sup>4</sup>

This could potentially be evidence that the assumption about the relation between the sonority hierarchy and lenition is wrong. However, there seems to be a more plausible, partly language-specific explanation to this. Glide segments are marked in the C<sub>1</sub> position of a cluster (Hamilton 1996). Obstruents are the most unmarked in C<sub>2</sub>. In situations where we would have glide-glide clusters, it seems that Yolngu favours blocking lenition of the suffix-initial stop, resulting in a glide-obstruent cluster, which is marginally more harmonic than a glide-glide cluster.

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<sup>3</sup> This explanation only accounts for formerly fortis stop-initial suffixes, such as ASSOC and PERL. It does not account for the variation in other suffixes such as ERG/INSTR in Djapu that show variation. These suffixes were not historically fortis-stop-initial.

<sup>4</sup> MMBD = Mother’s mother’s brother’s daughter.

It seems then that there might be a tension between the general lenition process and the phonotactics of Yolngu. However, an extended discussion of this is beyond the scope of this paper.

## 5.2 FINAL VOWEL DELETION AND OPACITY

The analysis of lenition in Yolngu presented in this paper accounts for most of the generalisations in the data. It accounts best for dialects such as Gaalpu, which lack a vowel-deletion rule in the alternating suffixes. However, it is unable to account for those sociolects in which vowel deletion occurs word-finally following a vowel-final stem (see section 2.4). Examples of this are shown below in (5-5) and (5-6):

(5-5) ju:lŋu-j                    ‘people-ERG’

(5-6) pumparu-w                ‘rock-DAT’

SONPRES only targets stops between non-nasal sonorants; that is, a two-sided context is needed in order for lenition to occur. In examples (5-5) and (5-6), only one side of the required two-sided context is present. These examples, therefore, do not meet the conditioning environment for SONPRES.

The forms in (5-5) and (5-6) can be derived with a standard ordered rule formalism, whereby lenition applies first then vowel deletion. However, this is a case of counterbleeding rule ordering, which is a kind of phonological opacity. In this section, I outline the problem, however, I do not propose a solution to this since this is beyond the scope of the present paper.

Phonological opacity refers to obscured rule generalisations exemplified in (5-7) below (from Kiparsky 1973: 79; see also Bakovic 2007: 219):

(5-7) A process P of the form  $A \rightarrow B / C\_D$  is *opaque* to the extent that there are surface representations of the form:

- a. A in the environment  $C\_D$ , [= *underapplication opacity*] or
- b. B derived by P in environments other than  $C\_D$  [= *overapplication opacity*]

(5-7b) describes the opaque generalisation that we are faced with in this analysis. Overapplication typically corresponds to counterbleeding rule orders, where a rule Q would have wiped out strings to which P could have applied to (that is, Q potentially *bleeds* P). However, since P is ordered before Q, the generalisation expressed by P

is true on the surface, although the reasons for P’s application are not apparent from these surface strings. In Yolngu this is exemplified in (5-8). Lenition applies in (5-8a) weakening the underlying suffix-initial stop to the corresponding semivowel. (5-8b) then applies deleting the word-final vowel. This results in a surface form that seems to reflect an overapplication of (5-8a), since the reasons for its application are not apparent from the surface form. That is, (5-8b) has obliterated the environment that conditioned (5-8a)’s application.

(5-8) ju:lŋu + -tu 'people-ERG'

(a)	ju:lŋu-ju	Lenition	: P
(b)	ju:lŋu-j	Vowel deletion	: Q
∴	ju:lŋuj		

Cases such as this are a notorious problem for OT analyses (Bakovic 2007). For argument’s sake, let us assume a markedness constraint \*V] which is defined in (5-9):

(5-9) \*V]: Assign one violation mark for every word-final vowel.

This needs to be ranked below IDENT-ROOT, since, if not, it would predict that root-final vowels delete all the time.<sup>5</sup> On the other hand, its relative ranking with respect to SONPRES is unclear. In the tableau below, I have chosen to rank \*V] over SONPRES for present purposes. In (5-10) candidate (5-10b) is the attested output. However, the constraint hierarchy predicts the correct output should be (5-10d), with final stop because it satisfies the markedness constraints as well as (5-10b) and, in addition, is more faithful. But –CV suffixes do not vary post-vocally and only the continuant form is found; we never find single stops.

(5-10) Opacity (Unattested optimal candidate indicated by ☞)

	/waṯu + ku/ 'dog-DAT'	IDENT-ROOT	*V]	SONPRES	IDENT[SON]
a.	waṯuwu		*!	*	*
☞ b.	waṯuw			*	*!
c.	waṯuku		*!	**	
☞ d.	waṯuk			*	

<sup>5</sup> The Dhuwal lexicon contains vowel-final roots, as in (5-3) and (5-4)

Furthermore, if \*V] is a valid constraint we would expect vowel deletion to occur in other contexts, such as in post-liquid position. (5-11) illustrates this. (5-11a) is the attested optimal candidate but it is predicted to be a losing candidate due to its violation of \*V]. (5-11b) fails because of its violation of the faithfulness constraint IDENT[SON]. Candidate (5-11d) is predicted to be optimal yet this is not attested despite the cluster [-lk-] being a permitted consonant cluster in Yolngu.

(5-11) Post-liquid position (Unattested optimal candidate indicated by ☞)

	/wirku] + ku/ 'unmarried girl-DAT'	IDENT-ROOT	*V]	SONPRES	IDENT[SON]
☞ a.	wirku]wu		*!	*	*
b.	wirku]w			*	*!
c.	wirku]ku		*!	**	
☞ d.	wirku]k			*	

We can show that the conditioning environment historically was a two-sided context since lenition never affected stops in C<sub>1</sub> position of a medial C<sub>1</sub>C<sub>2</sub> cluster. Moreover, the vowels in the Dhuwal sociolects are reconstructable to Proto-Yolngu and the Dhuwala variety is closer to older form. In Dhuwala, lenition, where it does occur, can be described without exception in a bilateral context. This is also true of dialects such as Gaalpu, which lack a vowel deletion rule with the alternating suffixes. Presumably, when intercontinuant lenition was extended to suffix initial position, the context was bilateral. At the time vowel-deletion was innovated in the Dhuwal sociolects, the lenition rule would have been bilateral. Whether or not this is still presently the grammar that children acquire however is unknown and should be the subject of future investigation.

## CHAPTER 6. CONCLUSION

In this chapter, I briefly summarise the analysis presented in this thesis and discuss the broader implications for phonological theory.

### 6.1 CONTINUANT-STOP ALTERNATIONS: LENITION AND HARDENING

In this thesis, I have presented an analysis of a continuant-stop alternation pattern in a number of varieties of Yolngu. Crucially, this alternation pattern is conditioned by a two-sided context, a generalisation that has been difficult to account for in previous theoretical accounts. I argued that the proposal presented in Kingston (2008), with some modification, was able to account for the lenition pattern conditioned by this context. In the resulting analysis, the alternations were the result of the interaction between two markedness constraints: SONPRES and SCL. The former is a constraint that bans non-sonorants from occurring between flanking sonorants. The latter reflects a general phonotactic constraint found in many Australian Aboriginal languages. The analysis argued for in this thesis captures the generalisation that *both* flanking segments are necessary for the conditioning of lenition. This is a crucial advantage over other existing accounts of lenition.

In chapter 4, I extended the analysis to account for hardening in Wubuy. Interestingly, the constraint hierarchy posited in chapter 3 was able to account for the hardening pattern in Wubuy. This is despite the difference in directionality of the processes involved. Therefore, in Yolngu and Wubuy, the crucial insight is that no matter what the underlying representation the alternations conform to phonotactic constraints that apply to the lexicon as a whole, thereby avoiding the duplication problem (Kenstowicz & Kisseberth 1977).

### 6.2 FUTURE DIRECTIONS & CONCLUDING COMMENTS

What has been presented in this thesis is a theoretically informed discussion of a widespread phonological pattern in Australian Aboriginal languages. The analysis has been able to account for many of the facts about the alternations in Yolngu and Wubuy. However, as discussed in chapter 5, there are a number of unresolved questions, most notably to do with variation in suffix realisation and counterbleeding opacity.

As I claimed, a purely synchronic understanding of the suffix forms in Yolngu does not give us the entire picture. Instead, it is necessary to consider the historical context of the languages and the processes that have occurred to produce the present forms (see Blevins 2004). But perhaps more importantly, the variation in suffix form poses a problem for synchronic analyses of sound systems when the factors affecting variation are unclear.

Additionally, as we saw, final-vowel deletion presents us with a case of counter-bleeding opacity. This kind of phonological opacity has been traditionally difficult to account for in OT Bakovic (2007). I argued that the historical context for lenition was a two-sided context. However, I suggested that it is unclear whether or not this is two-sided context is still part of the grammar that children acquire presently. Nevertheless, the allomorphs of the alternating suffixes that occur following vowel-final stems raise interesting questions regarding the consonant alternations in Yolngu.

In order to progress any further, however, more detailed phonological and phonetic descriptions need to be conducted on the language varieties discussed above. As I suggested in chapter 1, the analysis presented in this thesis does not take into account prosodic factors that could condition alternations. These factors have been shown to condition particular sound changes in a number of other Australian languages, and it also warrants further investigation.

In developing the analysis presented in this paper, I have contributed to the body of theoretically informed discussion on Australian languages, a language family that still has much to reveal to us. Just as importantly, this thesis adds to the broader literature on lenition in phonological theory, testing a proposal that is able to account for a very common conditioning environment. All in all, what I have presented is a small, but important, contribution to research both on Australian languages and in phonological theory.

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