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PREFACE

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INTRODUCTION TO SERIES A VOLUME 5

The papers in this volume deal with the phonologies of Nunggubuyu, Burarra, Kala Lagaw Ya, Murinbata, and some aspects of the higher level phonology of Walmatjari. Two papers dealing with orthographic decisions are also included.

Five of the papers in this volume are by SIL authors: Glasgow, Kennedy, Street and Hudson, with the Street paper co-authored by Gregory Panpawa Mollinjin. Their papers are herein being made available in preliminary form, and reader's comments would be appreciated by the authors. These papers normally will be further revised and published more widely elsewhere. The other three papers are by non-SIL authors: M. Hore (Church Missionary Society), J. Stokes (Church Missionary Society), and G. McKay (Northern Territory Education Department). With the exception of Graham McKay, the non-SIL authors have had some interaction with SIL personnel in the writing of their papers - usually of a consulting and/or editing nature. For this reason we are pleased to include their papers in this volume.

Michael Hore's paper primarily deals with rules for stress placement and the interaction of stress and length in Nunggubuyu. He is able to show that stress placement is predictable, given the distribution of long syllables. Interestingly, Michael's analysis hangs partly on the analytical decision that Nunggubuyu has a pre-nasalised series of stops - and he shows how this is motivated by the stress analysis. There is a further point of interest to those concerned with the notion of 'simplicity' as a grammar evaluation criterion; Michael shows that the present synchronic facts motivate two rules at quite different points in the cycle; the two rules are very similar, yet neither can be eliminated.

Kathy Glasgow presents the phonemes and morphophonemics of Burarra. Kathy has given considerable attention over the years to the possibility of a geminate versus non-geminate contrast in the stop series, as well as to other issues such as the interpretation of retroflexed sounds. This paper is the fruit of that research. Kathy's analysis places the Burarra orthography within the main stream of Australian phonologies; she rejects the 'geminate hypothesis' (mainly on the basis of mother-tongue speaker's reactions) and expounds a retroflexed order of sounds. In addition, she has divided what previously was analysed as a flapped apico-alveolar stop into a flapped apico-alveolar rhotic, and an apico-alveolar voiced stop. Interestingly, with these changes the segmental inventory is now the same as that in neighbouring languages.

Kathy's second paper deals with the proposed orthography for Burarra and the factors which influenced the decisions made. It is refreshing to see that Aboriginal people were consulted and felt free to take initiative in expressing their feelings concerning their own orthography. It is SIL policy to encourage and co-operate with the initiatives of Aboriginal people.

Rod Kennedy presents an account of Kala Lagaw Ya phonology (Mabuiag dialect, Torres Strait). Kala Lagaw Ya is a language of Australian descent, but heavily influenced by its proximity to the languages of Papua New Guinea.

Judy Stokes' paper on Anindilyakwa phonology is the fruit of many years of wrestling with what must be one of the most difficult of Australian phonologies. Judy gives a good, well documented account of the segmental phonology of the language. She alludes to the difficulties of finding a simple and transparent analysis of the high vowels. This is an area of interest, for it would appear that Anindilyakwa shares some features of the phonologies of Central Australian languages - which have labialised peripheral stops and a tendency to loss of contrast in the high vowels. Velma Leeding has addressed herself to the problem of the high vowels and labialised stops in Anindilyakwa, and is currently preparing a manuscript to be published elsewhere, dealing with these and other problems. Certainly, from a purely linguistic standpoint, Anindilyakwa is a most interesting language, and Judy's high quality work is a welcome addition to the literature on it.

The phonology paper by Chester Street and Gregory Panpawa Mollinjin is a re-written version of a paper on Murinbata which Chester wrote shortly after beginning study of the language. The morphophonemic changes dealt with would be of interest to anyone concerned with the idea of 'consonantal strength' in Natural generative phonology theory. Also included is a short dictionary of approximately 650 words.

Joyce Hudson's paper is a short account of some features of higher level phonology in Walmatjari. It deals with variations of intonational contours, and the grammatico-semantic parameters which correlate with such variations. The paper is partly based on text data which is included in some unpublished manuscripts on paragraph structure which Joyce wrote several years ago. The references to these texts have been left in the present paper, in the eventuality that the paragraph analysis will be published at a later date.

Finally, Graham McKay's paper gives the results of some testing of the acceptability of the digraph 'ny' as used in many Australian orthographies.

Bruce Waters
Volume Editor

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SYLLABLE LENGTH AND STRESS IN NUNGGUBUYU

Michael Hore

1. INTRODUCTION

1.1 BACKGROUND AND ACKNOWLEDGEMENTS

Nunggubuyu is spoken as a first language by approximately 300 adult speakers, and is the dominant Aboriginal language spoken at Numbulwar (formerly known as Rose River Mission) on the east coast of Arnhem Land. A number of speakers live on Groote Eylandt, and the language is understood by many in the region for whom it is not a first language.

Nunggubuyu is one of the 'prefixing languages' of Arnhem Land, i.e. it is not a 'Yuulngu' language (Heath 1978:3). Jeffrey Heath, who has done extensive work in the area, gives Ngandi and Anindilyakwa as the nearest genetic relatives of Nunggubuyu, while adding that this genetic proximity should not be exaggerated (Heath, 3-7; also personal communication).

The purpose of this study is to deal with the question of vowel length in Nunggubuyu which has been a source of difficulty in the past. While there are some minimal pairs showing length contrast, native speakers have not been writing length distinctions consistently. The solution that we present in this paper is that length, like stress, is a contrastive feature of the syllable. When length is taken into account, syllable stress within phonological words becomes entirely predictable, and so we present here the set of rules for stress placement, using a transformational-generative framework. It turns out that segmental details are relatively unimportant for stress placement but that it is syllables which are most significant. On this basis we make some notational innovations which have the effect of greatly simplifying and clarifying the presentation.

The data presented here comes from a variety of sources, including material originally recorded for different purposes. I should particularly thank Mrs Yulgi Nunggumajbarr, Mr Mungayana Nundhirribala, and Mr Langayina and Mrs Anne Rami.

I would like to thank Bruce Waters and Barbara Sayers of the Summer Institute of Linguistics for help and advice given, and also my wife who has been a sounding-board for many of my ideas. My thanks are also due to Professor Jeffrey Heath of Harvard University for sending me draft copies of his forthcoming voluminous work on Nunggubuyu, as well as copies of his field tapes and transcriptions.

1.2 ABBREVIATIONS

ABS	absolute
AUG	augment
DERIV	derivational
Du	dual
EPEN	epenthesis
F	feminine
HUM	human
INSTR	instrumental
NOM	nominalizer
NONPAST.2	verbal tense suffix
PAST.2	verbal tense suffix
PRF	prefix
RDP	reduplication
RECIP	reciprocal
REL	relative
SG	singular
sp.	species
ZSS	sister's son's son

1.3 NUNGGUBUYU PHONEMES

The orthography that will be used in this paper is basically the literacy orthography in use at Numbulwar. The consonant phonemes are given in Table 1.

TABLE 1

Nunggubuyu Consonants

	Bilabial	Interdental	Lamino-Palatal	Alveolar	Retroflex	Velar
Stops	b	dh	j	d	d	g
Prenasalised Stops	mb	ndh	ynj	nd	nd	ngg
Nasals	m	nh	ny*	n	n	ng
Laterals		lh		l	l	
Resonants	w		y	rr	r	

* yn is written syllable finally

Table 1 reveals one departure from previously published work on Nunggubuyu: we are analysing homorganic nasal-stop sequences as unit phonemes. There are a number of reasons for this, including the behaviour of such entities under the stress assignment rules that we will be presenting. We will therefore delay discussion of this question until section 3.3.

The vowel phonemes are i, a and u, also written lengthened, ii, aa, uu. We will be discussing the phonemic status of the lengthened vowels in this paper.

The Nunggubuyu consonant oppositions can also be placed into a distinctive features framework along the lines suggested by Waters (1979:56-61). This is done in Table 2.

TABLE 2

Consonant Oppositions

			+ dist		- dist
			+ periph	- periph	- periph
			+ ant	- ant	+ ant	- ant	+ ant	- ant
- cont	- son	- nas	b	g	dh	j	d	<u>d</u>
		+ nas	mb	ngg	ndh	ynj	nd	<u>nd</u>
	+ son		m	ng	nh	ny	n	<u>n</u>
+ cont	+ lat				lh		l	<u>l</u>
	- lat		w		y		rr	r

This is not the place for a full discussion of these distinctive features, particularly as they play only a small part in the remainder of this paper. Our framework differs in only minor respects from that used by Waters; this point is of interest as Djinang, which Waters describes, is a Yuulngu langage and is therefore separated by a vast genetic gulf from Nunggubuyu. The major difference between the systems is that for Djinang, Waters finds the feature Sonorant to be of more use than Continuant, and accordingly he groups the nasals with the laterals as + son, with the stops as - son. In Nunggubuyu, however, there are a number of phonological processes for which we need to group nasals with stops, and accordingly Continuant is a more useful feature than Sonorant, although we need to retain the latter in order to distinguish prenasalised stops from nasals. The only other

difference between our scheme and Waters' reflects the absence of a voiced/voiceless stop distinction in Nunggubuyu.

For completeness, we also include a fully specified feature matrix for all Nunggubuyu phonemes (Table 3). This includes the features High, Low and Back, needed for vowels, and also the non-contrastive features Voice, Round and Delayed Release, needed in order to handle the surface phonetic detail of the language. (It is possible that other features will eventually be found necessary for this purpose as well.) We have omitted the features Long and Stress, as we will be dealing with their status in detail in this paper.

1.4 MOTIVATION

This study was motivated by a desire to deal with the problem of emic vowel length in Nunggubuyu. I call this a problem for the following reasons:

(a) Firstly, there are a number of minimal pairs, proving the existence of an emic contrast between long and short vowels.

"yagi	negative particle
"yaagi	'here (human singular)'
"nguni	'it ate it (both non-human)'
"nguuni	'she gave it to her'

In these examples we have marked primary stress by the symbol " preceding the stressed syllable. (Later, we will use ' for secondary stress.) Notice that the length distinctions in these examples cannot have been influenced by the stress, but that we have genuine cases of contrastive vowel length. In spite of this, however, it has proved difficult for various workers (myself included) to distinguish long and short vowels consistently in practice.

(b) Native speakers are frequently confused when asked to distinguish length and do not usually write it consistently.

(c) There is an interplay between vowel length and the syllable stress pattern in a phonological word. (We will define the latter term more precisely shortly.) This interplay has never been adequately analysed.

Our aim here, then, is to present an analysis of both length and stress within Nunggubuyu phonological words.

TABLE 3

Fully Specified Feature Matrix

	b	dh	j	g	mb	ndh	ynj	ngg	m	nh	ny	ng	w	lh	y	d	d̲	nd	nd̲	n	n̲	l	l̲	rr	r	i	u	a
seg	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
syll	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	+
dist	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	−	−	−	−	−	−	−	−	−	−	−	−	−
periph	+	−	−	+	+	−	−	+	+	−	−	+	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−
ant	+	+	−	−	+	+	−	−	+	+	−	−	+	+	−	+	−	+	−	+	−	+	−	+	−	−	−	−
cont	−	−	−	−	−	−	−	−	−	−	−	−	+	+	+	−	−	−	−	−	−	+	+	+	+	+	+	+
son	−	−	−	−	−	−	−	−	+	+	+	+	+	+	+	−	−	−	−	+	+	+	+	+	+	+	+	+
nas	−	−	−	−	+	+	+	+	+	+	+	+	−	−	−	−	−	+	+	+	+	−	−	−	−	−	−	−
lat	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−	−	−	−	−	−	+	+	−	−	−	−	−
back	−	−	−	+	−	−	−	+	−	−	−	+	+	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+
low	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+
high	−	+	+	+	−	+	+	+	−	+	+	+	+	+	+	−	−	−	−	−	−	−	−	−	−	+	+	−
voice	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
round	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−
del rel	−	+	+	−	−	+	+	−	−	+	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−

1.5 RELATIONSHIP TO THE OVERALL PHONOLOGICAL SYSTEM

Since what we will be discussing here represents only one small part of the overall phonological system of Nunggubuyu, we will need to indicate how it relates to this whole system. We will begin by defining 'phonological word'.

There are rather a large number of phonological rules in Nunggubuyu (Heath, forthcoming, presents 51 separate rules) which, by and large, are bounded in their operation by grammatical word boundaries. We need not give the details of these rules here, especially as most of them have no influence on length or stress. We will give just one important example, the 'hardening rule'. This rule operates at a morpheme boundary, when the first morpheme ends in a stop or nasal and the second morpheme begins with an oral continuant consonant (i.e. the laterals and semivowels in Table 1). This continuant is hardened into a stop at the same point of articulation. Using distinctive features, we can write this rule as

$$[+\text{cont}] \longrightarrow [-\text{cont}] \;/\; [-\text{cont}] \_\_\_\_$$

Thus we have

amalhagayagbaj /ama + lhagayag + waj/
PRF — sea — beside
'beside the sea'

awumurrnduj /a + wumurrng + rruj/
PRF — house — at
'at the house'

This rule does not operate across a grammatical word boundary. Thus: walyinyung runggal 'a big man'
man big
not *walyinyung dunggal.

This situation is generally the case for Nunggubuyu phonological rules. We will therefore define a phonological word to correspond exactly to a grammatical word. We will use the customary symbol ## to mark such word boundaries. We will also need to recognise other boundaries within a word, and for these the symbols # and + (Hyman 1975:194ff) are appropriate; we will discuss this point in section 2.1.

When considering length and stress phenomena and their inter-relation, we will be able to confine ourselves almost entirely to phonological words and smaller units. There are higher-level stress phenomena, but we can ignore these here as in general they simply produce an intensified stress on a syllable that was stressed in any case. There are two exceptions that we will touch on briefly and then not consider further, as they have a number of peculiarities.

(a) Interjection intonation involves an utterance-final stress, often with extreme lengthening of the syllable and, if the vowel is /a/, a glide towards /u/.

(b) There is an intonation pattern which can be used on clauses denoting drawn-out, continuous action, characterised by a steady high pitch over the utterance with extreme lengthening of the final syllable, sometimes to four or five seconds. (There is one situation where it is not the final syllable, and that is when the completive particle nga terminates the utterance, with a fall in pitch.)

There are no other higher-level phenomena which can change the stress pattern on a word, and in particular, neighbouring words have no effect. We need add only one qualification to this statement: in rapid speech certain grammatical classes of word may receive no stress at all. We will describe this phenomenon in more detail later.

Stress is normally considered to be a prosodic feature of the syllable. In the case of contrastive length, however, there is not such a strong consensus. Is it a feature of the syllable, giving long and short syllable types, or is it a segmental feature, giving a separate inventory of long and short vowel phonemes? One could argue that as length is (typically) manifested on the syllable nucleus (the vowel), it is most logical to regard it as a feature of the vowel. On the other hand, many linguists have grouped length together with pitch and stress as a class of prosodic or suprasegmental features (see e.g. Collins 1979 who cites Bloomfield, Pike, Block and Trager, Chomsky and Halle, Lehiste and others as taking this view at various times). These suprasegmental features most commonly apply to the syllable.

I believe that in Nunggubuyu there are definite grounds for handling length as a feature of the syllable.

(a) Native speaker reaction seems to suggest this. There has been no particular problem teaching literacy using the three vowel phonemes a, i and u. Any attempt, however, to introduce long vowels as additional phonemes has led to confusion. Native speakers, even those who are fairly literate, remain unsure

about where they should write a vowel as long, if they do it anywhere. On the other hand, they have little difficulty reading words with or without length marked and regardless of where it is marked. I interpret this to mean that it is the *quality* of vowels which alone determines their phonemic status and that *duration*, while significant, is so at a different level.

(b) There is a regular process in the language whereby an underlying 'long vowel' loses its length, an underlying 'short vowel' is lengthened, and just one instance where length 'jumps' from one vowel or syllable to another. The first two phenomena can be shown to be induced by stress placement and timing considerations; we will discuss them later (sections 2.4.5 and 2.4.6). The case of 'length shift' is an irregularity and occurs with the noun meaning 'water'. A noun may appear with or without its class prefix, as in

rangag	'a tree'
ana-rangag	'the tree'

With the noun 'water', however, we find

guugu	'water'
anaa-gugu	'the water'

rather than the expected *ana-guugu.

These phenomena, especially the latter one, would be hard to account for if we posit separate long and short vowel phonemes. It rather appears that we have a feature of length which is functioning in a different way from the features which characterise segments.

These considerations would lead us to conclude that length should be regarded as a feature of some other unit than the segment, while not necessarily telling us *what* unit. There is no evidence, however, suggesting that the word is an appropriate unit; various numbers of 'long vowels' can appear in words in various positions.

maalamburrg	'proper'
anaani	'this (ANA class)'
ni-burraa	'he sat'
waamaamaja-yii	'like a thief'
naanananimaa	'he led him by the hand'
wurraarraalgaalgurmangi	'they prepared everything'

The appropriate unit of which length is a feature appears to be intermediate between the segment and the word. Particularly because of the interplay between length and stress, the syllable is the obvious choice.

This decision means that we have two syllable types, S and S·. As far as I can determine, the length of the syllable by itself imposes no constraint on the occurrence of phonemes in the syllable. A syllable may take the forms CV or CVC, with V or VC as possibilities word-initially, and CVCC a possibility word-finally. There are, as would be expected restrictions on the classes of phonemes which can appear in the various positions which are not relevant to us here. However, it appears that *any* of the possible forms can occur as either an S or an S·.

This analysis suggests the possibility that an S· might really be an SS sequence, with a (C)V syllable preceding a V(C) syllable. There are, in fact, a small number of words for which such as SS sequence is sometimes pronounced, in alternation with what is (apparently) a single S·.

'ana-"aja ~ a"naaja	/ana#aja/	'the shark'
	PRF-shark sp.	

In all such words an internal word boundary (#) occurs between the two syllables in question. In all other situations in which an S· occurs, however, it is never pronounced as SS, even in very slow speech. It therefore appears that the above phenomenon is associated with the boundary, so that the two morphemes are to some extent behaving as two separate words. Apart from this borderline situation, there is no evidence that a V(C) syllable can ever occur other than word initially. Any C that can appear in a syllable coda can also appear in the onset, but not vice versa; yet any C can appear intervocalically. The most natural conclusion is that in any VCV sequence the syllable boundary comes before the C. As well as this, a speaker can on occasions be induced to articulate a word syllable by syllable; we find then that a VCV sequence is always articulated as V, CV. As for sequences such as [uwa] or [iya], the semivowel is always clearly articulated in deliberate speech, and literate speakers always insist on its presence. Finally, we should observe that word-initial V(C) syllables only occur with the vowel /a/. Even when a word is underlying form has an initial /i/ or /u/, on the surface an initial semivowel is inserted, leading to yi- or wu-.

Assuming then that a word medial or final syllable must have an initial C, is it possible that underlying our long syllables we have -iyi- or uwu- sequences? Apart from the fact that such a theory could not account for long syllables containing /a/, we have a clear contrast in

niiri	'he is not here'
miyiri	'star'

and although I have not found a good minimal or sub-minimal pair for -uu- versus -uwu-, the sequence -uwu- is always clearly discernible in words such as

wulhuwulhurr 'first (in time)'

As a final argument against any analysis of S· as SS, it will become clear as we present the rules for stress assignment that an S· and an SS sequence are by no means interchangeable. There are points of similarity but also important points of difference. (See especially rules 4 and 6, and 11 and 14 as well as the discussion of rule 14, sections 2.4.6 and 2.5.) There are also the processes we referred to earlier, one which removes length from a syllable (rule 16) and one that adds length (rule 8), which we would hardly expect if an S· were an SS sequence.

2. STRESS ASSIGNMENT

2.1 INTRODUCTION

In this major section we will give an analysis of stress on Nunggubuyu phonological words. We will first need to make some remarks on how stress is manifested phonetically and then introduce the notion of stress groups.

Hyman (1975:207) gives three parameters which typically are phonetic cues of stress: intensity, pitch and duration. All are relevant in Nunggubuyu, especially pitch. Nunggubuyu words normally have an overall falling pitch contour and stressed syllables usually represent a slight delay in the lowering of pitch although sometimes, especially with primary stress, there can be an upward step. A stressed syllable is normally also marked by a slight increase in intensity or loudness, associated with increased muscular tension in articulation. Again this is most noticeable with primary stress. Duration does not appear to be a particularly significant cue for secondary stress, but again it is normal for the syllable carrying primary stress to have a quite noticeably increased duration. This can make the discernment of emic length particularly difficult on syllables with primary stress, unless a good contrastive pair can be found.

Phonological words in Nunggubuyu normally have one or more stressed syllables which typically are pronounced at approximately equal time intervals. We can account for the positioning of the stressed syllables in the word by breaking the word into 'stress groups', each of which has a single stressed syllable and zero or more un-stressed syllables.

This approach has also proved successful for Djinang (Waters 1979:83-7), although the rules for the formation of stress groups in Djinang are rather different from those operating in Nunggubuyu. For example, in Djinang, which has no emic vowel or syllable length, stress group breaks are determined primarily by which syllables are open or closed, together with the nature of the consonant commencing each open syllable. In Nunggubuyu, however, there is emic syllable length and a strong pressure to keep stressed syllables evenly spaced in time (and therefore to keep stress groups of approximately equal duration), and it is these timing factors which principally determine stress group breaks - in particular, which syllables are long or short.

The following are some words with stress group boundaries marked by a full stop:

'lhala."wu<u>l</u>bu<u>l</u>g	'ant sp.'
"maa<u>l</u>amburrg	'proper'
'ngalaa."ligi	'turtle'
dhu'maa.'mugu.'naa."murra	'snake sp.'

Before we present the rules for forming stress groups and assigning stress, we will need to consider the phonological boundaries that are significant in the formulation of the rules. As we indicated earlier, the boundaries that are customarily used in generative phonology prove helpful here. These are the full word boundary (##), the internal word boundary (#) and the morpheme boundary (+) (Hyman 1975:194ff). We have already defined a phonological (full) word to be identical to a grammatical word; morphemes within words will be separated by either # or +, depending on grammatical criteria that we will discuss in section 3.1. The + boundary has little significance phonologically, which is the normal situation in languages in general (Hyman 1975), and in particular for Nunggubuyu it plays no role in stress placement.

These examples illustrate # and + boundaries within words:

na#wa<u>l</u>yinyung#guy	
PRF - man - to	'to the man'
ama#lhagayag#duj	
PRF - sea - in	'in the sea'
anu+bani#yung	
PRF- that - one	'that one (ANA class)'

ngu # maga + yn
she/her-tell- PAST.1 'she told her'

wu + dangag
DERIV — tree 'wooden thing'

2.2 STRESS GROUPS

In this section we will discuss stress groups as they apply in Nunggubuyu phonology and introduce some of the more important rules governing stress group boundary placement. Then in the following sections we will present the rules for stress group boundary placement and stress assignment.

As we indicated earlier, the notion of stress groups has proved to be of value in the analysis of the stress pattern on Nunggubuyu words. To a degree stress groups are an abstraction in that their main function is to simplify the whole body of rules relating to stress. It is my feeling that for Nunggubuyu stress group boundaries may have a (barely detectable) surface phonetic manifestation, namely a very slight pause which may ensure that stresses are evenly spaced, especially in slow speech. This is a sporadic phenomenon, however, and it could be argued that it has other causes. Our main justification for positing stress groups at all is that they yield a simplification in the rules. Granted this, then, we have had to make a tradeoff between complication in the rules for forming stress groups and complication in the rules assigning stress within stress groups. We have chosen to define stress groups in a way that yields, in our view, the simplest overall description. The resulting stress group boundaries then correspond to the places where the occasional slight pause occurs; however this should probably not carry too much weight as evidence.

The most obvious fact about stress on Nunggubuyu words is that for words with short syllables only, the normal situation is that the first and penultimate syllables are stressed as well as the third, fifth etc. syllables, depending on the length of the word. Where the number of syllables is odd, the penultimate syllable is preceded by two unstressed syllables. The penultimate syllable receives the primary stress.

(1) 'lhala"wulbulg 'ant sp.'
'burrumbu"rrunga 'Pleiades star cluster'
'rawu'rrumugu"rrumu 'plant sp.'

This basically alternating stress pattern appears to be typical of Australian languages[1]. This pattern in Nunggubuyu immediately suggests that we posit a stress group type consisting of two short syllables, of which the first one is stressed. Our first significant problem arises when we attempt to deal with the two consecutive unstressed syllables preceding the penultimate syllable in words such as the second and third ones above, with an odd number of short syllables. Do we have, for example,

(a) 'burru.mbu"rrunga

(b) 'burrumbu."rrunga or

(c) 'burru.mbu."rrunga

Possibilities (b) and (c) have the advantage that they yield a rule that a stress group is stressed, if at all, on its first syllable. However, they produce difficulties in other areas. Words of form SSS are usually stressed on the middle syllable, so that under (b) or (c) we would have S.SS. This requires the assumption that a stress group of a single unstressed S is possible, which is inconsistent with the basic notion of a stress group as a set of syllables with one stress, each stress group having approximately equal duration to those around it. It is also difficult to give an account of SSS words which is consistent with that required for words of 5, 7 etc. short syllables. SSS words are stressed on the first syllable under certain conditions (which we will discuss later). Under (b) or (c) we would for these words have a single stress group. With the longer words, however, under (b) or (c) we cannot have a word-final SSS stress group, even if the conditions are apparently satisfied, except in the one case where a single S suffix has joined to the end. To account for these phenomena, we would require a number of *ad hoc* rules for which a reasonable motivation would be hard to find. Under (a), however, we can allow the longer words to be segmented with an SSS stress group at the end, and treat the above phenomena as questions of stress placement within stress groups rather than as questions of segmentation. This, as we shall see, will permit a consistent treatment of these phenomena along with several others in the language. We are therefore analysing the words (1) as

(2) 'lhala."wulbulg

'burru.mbu"rrunga

'rawu.'rrumu.gu"rrumu

Long syllables can be accounted for quite easily. Basically, each S· forms a stress group of its own; where, however, the S· is preceded or followed by a single S, the S can be included in the same stress group as the S·. The S· usually retains the stress when this occurs.

(3) mi'daa.'burru."burru 'plant sp.'

dhu'maa.'mugu.'naa."murra 'snake sp.'

We will now give a list of words to illustrate various stress group types and how they may appear within words.

Words of form SS

"yagi	negative particle
"bagu	'there'
"ngumij	'ant'
"marri	'and'
"landhurrg	'dog'

S·

"yii	'yes'
"yuul	'bushland'

S·S

"yaagi	'here (human referent)'
"lhaagi	'language'
"aani	'this (ANA class, non-nominative)'
"waari	negative particle
"wiiya	'finished'

SS·

bu"rrii	'it puts it'
ma"gaa	'it told it'
mi"daarrg	'secret'

SSS

ngu"jija	'fish'
a"daba	'now'
maj"barrwarr	'python'
nu"bini	'those two men'
wu"rugu	'billabong'

"wurrugu		'later'
"marriya		'food'

It can be seen that SSS - type stress groups are sometimes stressed on syllable 1 and sometimes on syllable 2. We will discuss this in section 2.4.3.

S·SS

"maa_lamburrg		'proper'
"_daabulu		'small goanna'
"wuubani		'that (ANA class, non-nominative)'

Notice that in these words the primary stress is on the initial long syllable with the following two unstressed syllables in the same stress group, rather than in a new stress group with the first of the pair stressed, as we might have expected. We will discuss the reasons for this in section 2.4.6.

SS·S

a"naani		'this (ANA class)'
yu"waani		'over there (ANA class)'
nga"rraa_lirr	/ngarra#a_lirr/ PRF - sun	'the sun'
a"naanga	/ana#anga/ PRF - camp	'the camp'

SS.S·

'wa_lga_l."waa	'it separated it'
'mu_ndu."gaa	'it collected it'
'mabi."riil	'water lily leaf'

S·.S·

'lhaa."lhaag	'almost'

SS.SS

'lhala."wulbulg	'ant species'
'anu."bani	'that (ANA class)'
'a_la."ga_la	'partway'

'mijbu."rrayung	'children'
'wugu."ndurru	'Milky Way'
S·.SS	
'ngalaa."ligi	'turtle'
'aynjaa."bugij	'one'
'midaa."mimi	'hard to find'
SS.SSS	
'burru.mbu"rrunga	'Pleiades star cluster'
'amba.la"lari	'poor'
'mala.nga"nyanay	'long way'
S·.SS.SS	
'ngaa.'dhiya."rrinya	'tree species'
SS·.SSS	
wa'rraa.rri"wana	'it congratulates it'
SS.SS.SS	
'mara.'garri."jinyung	'shark species'
SS·.SS.SS	
mi'ndaa.'burru."burru	'plant species'
SS.SS.SSS	
'rawu.'rrumu.gu"rrumu	'plant species'
'jirrij.'baynja.wa"ynjangaj	'insect species'
SS·.SS.S·.SS	
dhu'maa.'mugu.'naa."murra	'snake species'

2.3 INTRODUCTION TO THE RULES

We will now present the full set of rules relating to the syllable-level features of length and stress. After that we will discuss the ordering of the rules.

We will present the rules in a formal manner using the transformational cycle convention of generative phonology, as this yields a succinct and precise description of the processes at work.[2]

We propose, however, to make use of an unusual convention in the presentation of the rules, motivated by the particular significance that the syllable proves to have. This significance can be seen in the fact that almost all the rules turn out to deal with whole syllables rather than the segments comprising them. The segments themselves are largely irrelevant. The most important factors in the rules are syllable length and, once stress is assigned, what that stress is. As we have seen, these are features which in Nunggubuyu properly belong to the syllable. In particular, in assigning stress group boundaries, the important factors are syllable length, the position of previously assigned boundaries (. # and ##) and the actual number of syllables coming between such boundaries. With most of our rules dealing with whole syllables in this way, they would certainly be more readable if we could express them using the symbols S and S· for short and long syllables respectively, as we have been doing previously. What we propose, therefore, is that just as it is customary to write C and V as a shorthand for [-syll] and [+syll], we now write S and S· as a shorthand for $C\begin{bmatrix} V \\ -\ long \end{bmatrix}(C)$

and $C\begin{bmatrix} V \\ +long \end{bmatrix}(C)$ respectively, this being the normal form of a

syllable in Nunggubuyu. A syllable can also have the initial C omitted when ## precedes, or a final CC cluster when ## follows, so we will extend our convention to cover these possibilities. Thus ##S will be equivalent to $\#\#(C)\begin{bmatrix} V \\ -long \end{bmatrix}(C)$ and S## will be

equivalent to $C\begin{bmatrix} V \\ -long \end{bmatrix}(C)(C)\#\#$.

Under this convention, also, $\begin{bmatrix} S \\ 2\ stress \end{bmatrix}$ will be equivalent to

$C\begin{bmatrix} V \\ -long \\ 2\ stress \end{bmatrix}(C)$. Notice that we are writing length and stress

features as attaching to the syllable nucleus, as is customary in generative phonology. This is convenient for the sake of the formalism, although I would prefer to regard such features as prosodies of the whole syllable. The S and S· convention may be regarded partly as an attempt to capture this preference.[3]

We might note here the contrast between Nunggubuyu and Djinang for which Waters (1979) formulates his phonological rules entirely in terms of segments. In Djinang there is far more interplay between stress (and stress-related features) and segmental features than is the case in Nunggubuyu. Thus in Djinang the segmental feature Distributed plays a large part in determining stress group boundary placement, and in the other direction, stress and the related syllabic phenomenon 'prominence' induce segmental modifications — vowel-lowering and voiceless stop gemination. I have detected no such phenomena in Nunggubuyu, with the exception that a closed syllable can lead to a following stress group boundary in one restricted situation, and the stress placement on SSS - type stress groups does depend on segmental features. Looking at the overall picture for Nunggubuyu, however, it is clear that for stress placement, segmental features play a very minor role.

In the rules, we will make use of the boundary symbols (## # .). We will regard ## as being equivalent to two # boundaries in sequence rather than as a compound symbol for a single boundary. This approach will yield the simplest rule formulation.

To refer to any boundary, we will use the feature specification [-seg].

Our conventions for the application of the rules are similar to those used by Waters. Each rule is applied repeatedly to the string so long as there are suitable environments. Then the next rule is applied and so on. When the final rule can no longer be applied, the next cycle begins with rule 1 being applied if possible, and so on.

Chomsky and Halle (1968:16) make use of a convention that 'when primary stress is placed in a certain position, then all other stresses in the string under consideration at that point are automatically weakened by one.' Waters (1979:105) finds this convention unnecessary for Djinang; it is also unnecessary for Nunggubuyu. Perhaps significantly, neither language has a particularly hierarchical structure at the word level although Nunggubuyu does have an elaborate word-level morphology. We will, however, find useful a related convention that when stress is assigned to a stress group, any stress already assigned to another syllable of the stress group is removed. This convention is not structly necessary, as any stress removal could be made explicit; however, it is a straightforward convention and does slightly simplify the stress assignment rules.

2.4 DISCUSSION OF THE RULES

2.4.1 PRELIMINARIES

We will now discuss the rules individually. When we arrive at the final formulation of each rule, we will number it 'rule n' according to its ordering in the transformational cycle.

Before the cyclic rules apply, there are a large number of non-cyclic phonological rules which must apply to the string (among these are the hardening rule we described earlier); these are fully described in Heath (forthcoming), and are mostly not relevant to our purpose here. We will allude briefly to a few of these rules in what follows, and discuss the relative ordering of these rules and the cyclic rules in section 2.7. Apart from that, we need not be concerned with these other phonological rules here. One rule which must apply at this time, however, is a rule to delete + boundaries. These, as we have seen, have no significance for stress placement. (Alternatively, it may be possible to delete these boundaries even earlier by a readjustment rule [Chomsky and Halle 1968:9ff]. I will not deal with this question here.) This rule is simply

(1) $+ \longrightarrow \emptyset$

The first of the cyclic rules handles the regular vowel elision process in Nunggubuyu, which always results in a long syllable.

(rule 1) $$V\left(\left\{\begin{matrix}\#\\ \cdot\end{matrix}\right\}\right)V \longrightarrow \begin{bmatrix}1\\ +\text{long}\end{bmatrix} 2\ \emptyset$$

1 2 3

This rule becomes considerably more complicated if we require it to handle the qualities of the vowels involved.

Briefly, we find that i + a ⟶ ii, u + a ⟶ aa, and u + i ⟶ ii (with some exceptions), Also, as we might expect, i + i ⟶ ii, a + a ⟶ aa and u + u ⟶ uu. The other combinations are fairly rare and the results are not the same in every grammatical situation. (Heath, forthcoming, gives a full description.) It turns out, however, that the resulting vowel quality has no significance for stress placement; the only important factor is that a long syllable is generated. For clarity, therefore, we have omitted the extra detail from this rule.

Notice that any stress group or word boundary separating the original two syllables moves to the right of the resulting syllable; this includes any associated labelled bracketing.

2.4.2 SEGMENTATION

We now come to the set of rules which handles the segmentation of the syllable string into stress groups. As we saw in section 2.2, the basic pattern is for stress groups to consist of one long or two short syllables. This suggests that we might formulate the following rules:

(2) $\emptyset \longrightarrow . \Big/ \begin{cases} [+seg]\_\_\_S\cdot \\ S\cdot\_\_\_[+seg] \end{cases}$

(3) $\emptyset \longrightarrow . \Big/ [-seg]\ SS\_\_\_[+seg]$

The function of the +seg items in these rules is to prevent the insertion of a . boundary adjacent to another boundary.

We will need to make only one modification to rules (2) and (3) resulting from the fact that stress groups of the form SS·, S·S, SSS and even SSSS are possible. These forms can occur when an otherwise unpaired S joins on to an adjacent stress group. This joining process can be handled by separate rules (and indeed we will need such rules to handle single S prefixes and suffixes). However (2) and (3) would then break these syllables off again in the next cycle. To prevent this it will be sufficient if we modify the rules so that they are blocked if stress has been assigned to any of the syllables in question. (See example (14) below for further evidence supporting this approach.)

(rule 4) $\emptyset \longrightarrow . \Big/ \begin{cases} [+seg]\_\_\_\begin{bmatrix} S\cdot \\ -stress \end{bmatrix} \\ \begin{bmatrix} S\cdot \\ -stress \end{bmatrix}\_\_[+seg] \end{cases}$

(rule 6) $\emptyset \longrightarrow . \Big/ [-seg]\begin{bmatrix} S \\ -stress \end{bmatrix}\begin{bmatrix} S \\ -stress \end{bmatrix}\_\_\_[+seg]$

We need one further segmentation rule. When a closed S is followed by an open S with no following boundary, it appears that the open S 'prefers' to join the stress group to its right rather than to its left. In any case, the effect is that in this situation we must place a . after the closed S, and that this must be done before rule 6 operates. Thus we have

(rule 5) $\emptyset \longrightarrow . / C\_\_\_CVS$

We can see rules 5 and 6 at work in

(4) bira + ngarrdha + ngarrdha + nga + j + yinyung
tail - RDP - high - AUG - NOM - REL 'scorpion'

⟶ birangarrdhangarrdhangajyinyung (+ deletion)

⟶ birangarrdhangarrdhangajinyung (hardening and geminate contraction)

⟶ birangarr.dhangarr.dhanga.jinyung (rule 5)

eventually leading to

bi'rangarr.'dhangarr.'dhanga."jinyung

If rule 5 had not operated, rule 6 would have yielded

bira.ngarrdha.ngarrdha.ngajinyung

leading to

*'bira.'ngarrdha.'ngarrdha.nga"jinyung

Rules 4 to 6 complete the initial segmentation of the string; there are, however, some situations requiring adjustment to stress groups. One of the most important is that suffixes consisting of a single S always combine with the stress group on their left, so that an original SS#S becomes SSS, and S·#S becomes S·S. In the case of S·S#S and SSS#S, we get resegmentation, yielding S·.SS and SS.SS respectively.

(5) 'ama.'lhaga."yagbaj /ama # lhagayag # waj/
PRF - sea - beside
'beside the sea'

In the case of suffixes (or prefixes) which are longer than a single S, the correct output is obtained if we simply change the intervening # boundary to . boundary.

(6) "wubuy.'mirri /wubuy # mirri/
wubuy - INSTR
'In Wubuy (i.e. Nunggubuyu language)'

(7) 'yii.la"bama.'yii /yii#labama#yii/
PRF-moon - like 'like the moon'

(8) 'ama.lha"gayag.'jinyung /ama#lhagayag#yinyung/
PRF- sea - REL 'of the sea'

These facts clearly suggest that we formulate two rules, the first of which replaces # internal to the string by . , and the second of which deletes . preceding a single S suffix or, more precisely, before an unstressed S which is already followed by a boundary. (This will exclude a single S stem which, as we shall see, will be carrying [1 stress] at this point and will need to be handled differently.) Once this rule has applied, any necessary resegmentation will be taken care of automatically on the next cycle.

(9) # ⟶ . /[+seg] ____ [+seg]

(rule 7) . ⟶ Ø / ___ $\begin{bmatrix} S \\ -stress \end{bmatrix}$ [-seg]

We will need to make a qualification to (9) to cover the case of verbs. A verb will normally have the form

$$\underset{VERB}{[\#} \; X \; \underset{STEM}{[\#} \; Y \; \#] \; \underset{STEM}{\#]} \; \underset{VERB}{}$$

where X is a string representing a pronominal prefix, and Y a string representing the stem along with an inflectional and possibly a derivational suffix. (In section 3.1 we explain our reasons for combining these suffixes with the stem.) We assume that a readjustment rule deletes the # following Y, so that we do not have a case of ## within a word; this means that for our purposes here the string will have the form

$$\underset{VERB}{[\#} \; X \; \underset{STEM}{[\#} \; Y \underset{STEM}{]} \; \# \; \underset{VERB}{]}$$

X may be null, in which case we will have

$$\underset{VERB}{[\#} \; \underset{STEM}{[} \; Y \; \underset{STEM}{]} \; \underset{VERB}{\#]}$$

On the other hand, other morphemes may sometimes be interposed between the prefix and the stem, giving for example

$$\underset{VERB}{[\#} \; X \; \# \; Z \; \underset{STEM}{[\#} \; Y \underset{STEM}{]} \; \underset{VERB}{\#]}$$

while another suffix may be added, so that we may have

$$\underset{VERB}{[\#} \; X \; \# \; Z \; \underset{STEM}{[\#} \; Y \; \underset{STEM}{\#]} \; W \; \underset{VERB}{\#]}$$

as in

'wuu.lha'garra."yara.'wugij

/wuu#lhagarra#ya+ra#wugij/

they- all-sleep-NONPAST.2-still 'they are all still sleeping.'

The point that is significant here is that, as we shall see in a moment, the # boundaries within the VERB brackets cannot be replaced at this point in the cycle. (Any # boundaries within the stem will have been removed earlier - see section 3.1.) We must therefore reformulate (9) to exclude such boundaries:

(rule 2)

$$\# \longrightarrow . \; / \; [+seg] \underline{\quad} \; X \; \#]_{NV}$$

where X is any string and NV represents any grammatical category except VERB.

The rule to replace # boundaries within verbs must come towards the end of the cycle. As rule 2 has already removed all other string-internal # boundaries, we can formulate this rule simply to replace those still remaining.

(rule 19) $\# \longrightarrow . \; / \; [+seg] \underline{\quad} [+seg]$

We have now presented two rules performing the same function (replacement of # boundaries) for two different grammatical categories and coming at different points in the cycle. This unusual approach is motivated by several important differences in the stress patterning between verbs and non-verbs, which we shall discuss in sections 2.4.4 and 2.4.6. These differences can be satisfactorily accounted for if we postulate that the # boundary within verbs is retained longer than other # boundaries. An alternative approach would have been to introduce a new kind of boundary, but this would be no simpler.

So far we have accounted for single S suffixes and all longer suffixes and prefixes. It remains for us to deal with single S prefixes. The situation here is not easy to determine since in most cases, whether or not we postulate that the prefix has joined the stress group to its right, we do not arrive at a change in the stress pattern on the word. This is so in the most common situation where the following syllable is stressed, as in

(10) na"wuwag or na."wuwag /na#wuwag/ 'the crow'
PRF-crow

Where the following syllable is unstressed, however, we do have a clear-cut situation, for the prefix always becomes stressed, requiring us to resegment the word, placing the prefix and the following syllable in a new stress group.

(11) 'nama."rrarayn /na#mararrayn/ 'the green ant'
PRF-green.ant

This process simply reflects the normal alternating stress pattern for short syllables.

For those cases where the S prefix is followed by a stressed syllable, however, there seems to be only one way in which we could determine the outcome: that is where the prefix, if it joined the stress group to its right, would result in an SSS stress group satisfying the conditions for initial stress (we discuss these in the next section). This would then bring about a stress shift on to the prefix. In fact I have been able to find only one word for which these conditions are satisfied and here, indeed, the stress shifts.

(12) 'niriyal."dhangi /ni#riyaldha+ngi/ 'he was angry'
he-be.angry-PAST.2

It therefore does appear that a single S prefix joins to the stress group on the right. We therefore have

(13) . $\longrightarrow$ Ø / [-seg]$_S$ ____

We should note that this rule correctly leads to resegmentation on the next cycle, if the syllable to the right is unstressed. Where the syllable is stressed, the pairwise segmentation rule (rule 6) will be blocked by the presence of the stress. This is what we require in the case of (12) above, and also for words such as

(14) a"marriya /a#marriya/ 'the food (non-nominative)'
PRF- food

This is one situation where an SSSS stress group can occur — where a single S prefix is followed by an SSS stress group stressed on the first syllable. Resegmentation of this word would lead to the erroneous output *'ama."rriya .

We will need to make some modifications to (13) to yield the final form of this rule. As with rule 7, we will need to prevent this rule from applying to a single S stem (which will be carrying [1 stress]). However, in one situation involving reduplication which we will discuss later, it is possible for such an S to be followed by another S carrying [1 stress]; in this situation we will want the rule to operate and also to remove the stress from the first S.

We may now write the rule as

(rule 3) $[-\text{seg}]\begin{bmatrix}S\\ \alpha\ \text{stress}\end{bmatrix}_1 \; C\begin{bmatrix}V\\ \beta\ \text{stress}\end{bmatrix}_2 \longrightarrow {}_3\begin{bmatrix}2\\ -\ \text{stress}\end{bmatrix}_4 \; \emptyset_5$

unless $\alpha = 1$ and $\beta \neq 1$

Notice that in this rule we have used a C and V to describe the second syllable, rather than our S - notation. The reason for this is that the syllable may be long or short, whereas S implies [-long] and S· implies [+long]. The S - notation would therefore be clumsy, as well as overspecifying the rule. We could easily get around this by introducing a third S symbol, S' say, to mean a syllable without length specification. It turns out, however, that we would need this symbol in only this one rule; it does not therefore seem justified.

2.4.3 STRESS ASSIGNMENT

We will now consider the rules assigning stress to stress groups. As we have seen, an SS stress group is always stressed on the first syllable, an SSS stress group is normally stressed on the second, and any stress group containing a long syllable is normally stressed on that syllable. We can combine all these facts into one general rule:

(15) $[-\text{stress}] \longrightarrow [2\,\text{stress}] \;/\; [-\text{seg}]\,(S)\begin{Bmatrix}[\overline{S}\,] \\ [\overline{S\cdot}\,]\end{Bmatrix} S$

We must, however, also take into account the exceptional cases, which are that an SSS or SS· stress group *can* be stressed on the first syllable in some circumstances. We will deal with these facts via separate rules, to be discussed shortly; we will, however, also need to modify (15) so that it will not reassign stress if one of these other rules has placed it on the first syllable. Thus we have

(rule 13) $[-\text{stress}] \longrightarrow [2\,\text{stress}] \;/\; [-\text{seg}]\left(\begin{bmatrix}S\\ -\text{stress}\end{bmatrix}\right)\begin{Bmatrix}[\overline{S}\,] \\ [\overline{S\cdot}\,]\end{Bmatrix} S$

Turning now to consider SSS stress groups, we find that this is an area of some complexity. These stress groups are normally stressed on the middle syllable, but sometimes the stress is on the first syllable. The conditions for initial stress appear to be these:

A. The stress group is word-initial, *and*

B. Syllables 1 and 2 are open, *and*

C. One of the following holds:

(a) The vowel in syllable 2 is /i/ and syllable 3 begins with /y/.

(b) The vowels in the three syllables are the same and syllable 2 begins with rr.

(c) The vowels in the three syllables are all /a/ or all /u/ and syllable 2 begins with a velar consonant, unless this consonant is /g/ and the third syllable begins with a resonant.

We will discuss condition A after we have looked at conditions B and C in more detail. The connecting factor in this rather strange set of conditions appears to be that when they apply, syllable 2 becomes particularly lenis, so that the stress group starts to behave in some respects as an SS (or perhaps an S·S) stress group, these being always stressed on the first syllable. Condition B is consistent with this idea. Looking at condition C, in case (a), this lenition of syllable 2 is presumably the result of its nucleus being dominated by the following homorganic consonant /y/. This would be corroborated by the fact that several three-syllable words in this category have a variant pronunciation with this syllable omitted altogether, such as "marriya ~ "marrya 'food'

In cases (b) and (c) the significant fact appears to be that very little articular movement is required to pronounce the consonant between syllables 1 and 2, so that these two syllables can be pronounced together easily and quickly and acquire some of the characteristics of a single syllable. It is not yet clear why syllable 3 must have the same vowel as syllables 1 and 2 in such stress groups.

Case (b) examples:

(16) "murruyung 'sibling'
"wurrugu 'later'
"arraga 'suddenly'

Case (c) examples:

(17) "lhungujun 'ankle'
"mungulu 'seaweed'
"mangarag 'sand'
"yungguyung 'in order that'
"magabang 'sandhill'
"bagalang 'eye'

The extra proviso on condition (c), that it does not apply when syllable 2 begins with g and syllable 3 with a resonant, I have

included on the basis of three examples:

lha"gayag	'sea'	
nga"gara	'bone'	and
-lha'garra-	'all'	(this last

morpheme does not occur in isolation but always forms a stress group preceded by #, within a verb complex).

We will now look at condition A, i.e. that the stress group must be word initial, and this will also provide a clue as to how we might formulate a rule to cover these stress groups.

Condition A would imply that word medial SSS stress groups must be stressed on syllable 2. In fact word medial SSS stress groups are extremely rare and I have so far found none satisfying conditions B and C. There is no doubt, however, that word final SSS stress groups are always stressed on syllable 2, regardless of conditions B and C, as in

(18) 'rawu.'rrumu.gu"rrumu	'plant sp.'	
'didil.ma"rrangga	'emu-like spirit'	

Strictly speaking, therefore, we could have made condition A specify that the SSS stress group not be word final; we would, however, need to exclude SSS words from this statement.

We must also take into account one further fact. When an SSS stress group is formed by suffix addition (see rule 7 above), then although the stress group is word final, it can be stressed on syllable 1 if conditions B and C apply. We see this most clearly in demonstrative forms with the addition of the Absolute suffix -yung:

(19) 'warru."burruyung	/warru+burru#yung/ PRF -there-ABS	'those ones (human pl.)'
'ngarru."bagiyung	/ngarru+bagi#yung/ PRF -there-ABS	'that one (feminine)'
'warru."bawiyung	/warru+bawi#yung/ PRF -there-ABS	'that one (WARRA class)'

but

'warru.ba"wayung	/warru+bawa#yung/ PRF -there-ABS	'that one (WARRA class, alternative form)'

The first three of these examples satisfy conditions B and C, but the last, which is a variant of the previous one, does not satisfy condition C, and the SSS stress group is duly stressed on syllable 2.

How are we to deal with these facts? In the case of examples such as (19), it is probably significant that the unsuffixed forms of these words all have a stress on the penultimate syllable, as in

(20) 'warru."burru 'those (human pl.)'

This means that in the derivation of the suffixed forms under the transformational cycle, we have underlying forms such as

(21) 'warru."burru#yung

which leads via rule 7 to

(22) 'warru."burruyung

Thus in these cases, the most straightforward way to handle the stress placement on the SSS stress groups is via a rule that moves the stress from the first to the second syllable, *unless* conditions B and C apply. This would also immediately account for the fact that word-final SSS stress groups in examples such as (18) are always stressed on syllable 2; such stress groups presumably have no underlying stress on syllable 1.

How, then, are we to account for condition A, that is, that word-initial stress groups are stressed on syllable 1 where conditions B and C apply? The solution that suggests itself is that there is an underlying stress on the first syllable. This stress would have to be assigned by a separate rule.

This is not the only possible analysis of the stress placement on SSS stress groups, but it is the simplest. Its main disadvantage is that we must postulate an underlying initial stress on word-initial SSS stress groups, which is not realised on the surface in the majority of cases. We should, therefore, look for further evidence of such an underlying stress. This is, in fact, forthcoming as we shall see later.

We may therefore formulate a rule assigning initial stress to a word-initial stress group:

(23) $[-\text{stress}] \longrightarrow [2\text{stress}] \;/\; \#[\overline{S}]\ SS\ [-\text{seg}]$

Note that the initial boundary in the environment can be # or ##, as in

(24)	'ana."marriya	/ana#marriya/ PRF- food	'the food'
	na"murruyung	/na#murruyung/ PRF- sibling	'brother'

(25) 'niriyal."dhangi /##ni#riyaldha+ngi/ 'he was angry'
he-be.angry-PAST.2

In (25) the initial SSS stress group is formed when rule 3 joins the prefix ni- to the stress group to its right. In this case both rule 3 and the initial stress rule have operated on the cycle following the word-level cycle, since the word is a verb, which means that the # boundary is not removed until the end of the word-level cycle. We will need to refer to this fact again shortly.

We need to make some minor adjustments to (23) to arrive at the final formulation of this rule. The first is in order to account for

(26) ngan_ "jarrawayn personal name[4]

For this word, the initial segmentation rules (4 and 5) produce ngan_.jarra.wayn which rule 7 converts to ngan_.jarrawayn. As the SSS stress group has initial stress, we assume that the word-initial stress rule must apply to this word. The significant factor is apparently not that the stress group is word-initial, but rather that its stress is the first stress in the word, i.e. that it is the first complete stress group in the word. A single S can thus precede this stress group. We must therefore modify (23) so that it applies to a string of the form #(S.)SSS[-seg].

We need to make one further modification to this rule. The rule should not apply where the SSS stress group carries primary stress. This is clearly so if this stress is already on the first S. If it is on the second S, the rule should not move it to the first S; the reason for this is that (as we shall see) primary stress must always be on a stem, whereas this rule could move it forward on to an S prefix. In the situation where the whole SSS stress group belongs to the stem, stress will already have been correctly placed on an earlier cycle. At that stage, when this point was reached, the stress would have been specified as [2 stress], being converted later in the cycle to [1 stress]. This rule was therefore free to operate on that earlier cycle.

We therefore have

(rule 9) $[\text{-stress}] \longrightarrow [\text{2 stress}] \,/\, \#(S.)\left[\begin{smallmatrix}\\ \overline{} \\ S\end{smallmatrix}\right]\left[\begin{smallmatrix}S \\ \alpha\ \text{stress}\end{smallmatrix}\right] S[\text{-seg}]$

where α = - or 2.

Another point emerges from this discussion. When we introduced rule 3 (which joins a single S on to the stress group to its right), we did not discuss its ordering; we are now in a position to do so.

In (26) rule 3 has operated on the second cycle to convert ngan."jarrawayn to ngan"jarrawayn. This rule cannot operate on the first cycle since at the point where it is reached, no boundaries exist. It is, in fact, necessary that this rule not operate on this particular word before rule 9, since otherwise we would obtain *nganjarrawayn, to which rule 9 could never apply, but which would resegment, eventually yielding *'nganja."rrawayn. It is, however, necessary for rule 3 to be ordered before rule 9; in our discussion of example (25) above we observed that these two rules must, for that example, operate in that order on the cycle following the word-level cycle. (It is impossible for rule 9 to operate on any subsequent cycle as it contains a # in its environment, and all such boundaries are removed by the end of that cycle.)

It now remains for us to formulate the rule that moves initial stress on an SSS stress group on to the medial syllable where conditions B or C are not satisfied.

rule 12 $$[\text{-seg}]\begin{bmatrix} S \\ \alpha\ \text{stress}\end{bmatrix}\ S\ \ S\ [\text{-seg}] \longrightarrow 1\ \ 2\begin{bmatrix}3 \\ \alpha\ \text{stress}\end{bmatrix}\ 4\ \ 5$$

$$1 \qquad 2 \qquad 3\ \ 4 \qquad 5$$

where α = 1 or 2

This rule does *not* apply if the stress group has the form

$$C_1V_1C_2V_2C_3V_3(C)\ (C)$$

and one of the following conditions holds:

(a) V_2 = i and C_3 = y

(b) $V_1 = V_2 = V_3$ and C_2 = rr

(c) $V_1 = V_2 = V_3$ = a or u, and C_2 = g, ngg or ng,

unless C_2 = g and C_3 = y, w, rr, or r

2.4.4 FIVE-SYLLABLE ADJUSTMENT

We will now deal with a resegmentation that takes place when we have a string of the form #SSS.SS#, resulting from an initial closed syllable or S prefix leading to #S.SS.SS# which rule 3 converts to #SSS.SS#. Resegmentation takes place to the normal five-syllable form #SS.SSS#.

(27)	'nayi.mi"darri	/na#yimidarri/ PRF- milkfish	'the milkfish'
	'nayi.nggul"bandi	/na#yinggulbandi/ PRF-barramundi	'the barramundi'
	'nayi.wa"nggunyung	/na# yiwanggu#nyung/ PRF- old -HUM.SG	'the old man'
	'nani.mu"wajung	/na# ni# muwaj#yung/ PRF-DERIV-name-HUM.SG	'his name'

I have not observed any equivalent process at work with strings of other than five short syllables. With one, two or three syllables, the segmentation rules yield a single stress group which could not resegment. With six syllables, we can under some circumstances arrive at #SSS.SSS#, but this does not resegment to #SS.SS.SS#, as we see from

(28)	na'burru.mbu"rrunga	/na#burrumburrunga/ PRF- Pleiades	'the Pleiades star cluster'

Likewise with seven short syllables, we see that #SSS.SS.SS# does not resegment:

(29)	na'rangga.'mbinyi."ngayung		
	/na#ranggambinying#ayung/ PRF- ZSS - 3rd.PERSON		'his sister's son's son'

We further observe that this rule does not apply when we have #SSS.SS# arising from the addition of a pronominal (verbal) prefix:

(30)	ngi'jiji."bini	/ngi#jijibi+ni/ she-hide -PAST.2	'she was hiding'
(31)	nga'ngaji."wanggu	/nga#ngajiwanggu/ I - old.woman	'I am an old woman'

In all such situations we are regarding the resulting construction as being labelled VERB, even where the stem is an adjectival stem as in (31) above. The # boundary between the prefix and the stem is therefore not replaced by rule 2, but remains until replaced by rule 19 at the end of the word-level cycle. Presumably this fact is significant here.

How can we satisfactorily account for this resegmentation? It turns out that if we consider it in conjunction with the SSS stress group initial stress rule (rule 9) that we discussed above, we can arrive at a plausible explanation. It is this fact that constitutes the additional evidence for that particular analysis, alluded to in our earlier discussion.

If we have a stem or prefix + stem of the form #S.SS.SS# or #S#SS.SS# respectively, then on the stem-level cycle, stress will be assigned by rule 13 to yield #S.'SS.'SS# or #S#'SS.'SS#. Primary stress assignment (to be discussed later) will convert this to #S.'SS."SS# or #S#'SS."SS#. On the word-level cycle, rule 2 will convert the second of these alternatives to be the same as the first, provided the string is not labelled VERB. Rule 3 will now yield #S'SS."SS. Rule 2 may also replace one or both remaining # boundaries; we only require that it does not replace the first (i.e. this is string-initial on this cycle or else the string is labelled VERB). Rule 3 will now yield #S'SS."SS. Rule 9 will now move the stress on the SSS stress group to the first S, yielding #'SSS."SS. The adjustment we are considering here must now convert this to #'SS.S"SS. Note that there is no shift in stress so long as this rule is ordered before rule 12, which could otherwise produce #S'SS.'SS, requiring the adjustment rule to restore the previous stress pattern.

Our explanation for the adjustment rule is therefore that it acts to prevent further shift in the stress pattern on the five-syllable string, at a point in the derivation where the stress pattern corresponds to the normal stress pattern for five-syllable words. This analysis accounts for all the apparent oddities connected with this resegmentation. For a six-syllable string of form #'SSS."SSS (which can result from certain kinds of frozen reduplication) or #'SSS.S"SS, the stress pattern does not correspond to the normal pattern for strings of six short syllables (#'SS.'SS."SS); so on our analysis here, any resegmentation would be unmotivated. This same argument applies to any even-numbered syllable string. For seven syllables, we can at this point in the derivation have #'SSS.'SS."SS; however this also does not correspond in stress pattern to the norm (#'SS.'SS.S"SS). so again there is no motivation for resegmentation. This could only occur if we had at this point #'SS.'SSS."SS (which could perhaps result from an earlier #SS#SSS.SS#, where the SSS stress group meets the conditions for initial stress). In fact there would be no way of telling whether or not resegmentation occurred, as even without it we would expect no subsequent change in stress patterning. In any case, I have no words of this form in my data. This same argument applies to all longer odd-numbered strings of syllables.
Note also that for verbs, if the string has the form

(32) [# S[# 'SS."SS] #]
VERB STEM STEM VERB

where the first S is a pronominal prefix, then the rule cannot operate on the word-level cycle, as the required stress pattern is not present. This is just as we require (although we will need to ensure that the rule cannot operate on any subsequent cycle). If,

however, the string has the form

(33) [# X [# 'SSS."SS] #]
VERB STEM STEM VERB

where X is any string representing a pronominal prefix, then the required stress pattern *is* present, on the stem. We can see that indeed the adjustment rule does operate in such a situation.

(34) 'banu.'man-ga.la"gana

/banu#man-galaga+na/
you/him-be.kind.to-NONPAST.2

In the stem-level cycle, the initial segmentation rules yield

(35) banu#man.gala.gana

as the first syllable of the stem is closed. By the end of the stem-level cycle we have

(36) banu#man.'gala."gana.

On the word level cycle, rule 2 does not replace the # boundary since this word is a verb. Rule 3 joins the syllable -man- to the right:

(37) banu#man'gala."gana.

Rule 9 now applies:

(38) banu#'man-gala."gana

By comparing (38) to the desired output (34), it is clear that five-syllable adjustment has occurred.

We are now in a position to formulate the adjustment rule. The string on which the rule is to operate apparently has the form

(39) $\#\begin{bmatrix}S\\2\ stress\end{bmatrix}$ SS.$\begin{bmatrix}S\\1\ stress\end{bmatrix}$ S [-seg]

Some of these items are, however, redundant and can be omitted. It is necessary for this rule to follow rule 9 (which fronts the stress on the SSS stress group) and before rule 12 (which may retract this stress). Any string beginning #SSS. will have triggered rule 9, therefore the [2 stress] specification is redundant. We cannot take the alternative approach and omit the # while specifying [2 stress], for as we saw above at (32), the rule must not be allowed to operate after the word-level cycle, while rule 9 can operate then (see example (25) above, and the discussion there).

Further redundant items are the S[-seg] at the end of the string. The rule assigning primary stress (see below) will imply that these items must follow a $\begin{bmatrix}S\\1\ stress\end{bmatrix}$. The following S can only be absent

where the syllable with primary stress is long. This raises the question as to whether the five-syllable adjustment rule could operate on a string of form #'SSS."S·[-seg]. I have no data to show whether the rule does apply, but on the basis of our earlier discussion as to the possible motivation for the rule, it appears that it could apply. Assuming this to be the case, we can specify the string simply as #SSS.[1 stress]. We can now formulate the rule:

(rule 11) # S S S .[1 stress] ⟶ 1 2 3 5 4 6
1 2 3 4 5 6

Finally, we should note that occasionally this rule does not apply when we might expect it. For example, instead of the normal 'nayi.ngul"bandi (as in (27) above) I have on tape an instance of na'yinggul."bandi. Possibly we should handle these occasional failures of the rule to apply by postulating that rule 2 (which replaces # boundaries except for verbs) may occasionally be omitted, leaving it to rule 19 to replace these boundaries. A possible basis for this is that since it is normal to indicate new information by omitting the class prefix on a noun (Hore 1979), a more subtle kind of highlighting may be achieved with the prefix present, by the retention of the intervening # boundary to the end of the word-level cycle, which allows the first syllable of the stem to retain its stress. This theory must, however, remain in the highly tentative category for the present. These facts do suggest, in any case, that there is a certain instability regarding rules 2 and 19. As we have observed, having two rules performing essentially the same function is unusual. We shall also see later (section 2.4.6) that there is a situation in which, occasionally, rule 2 apparently applies to verbs. This would be further evidence of instability, although this time acting in the other direction. The conditioning factor in this case, as we shall point out, is probably speed of speech.

These phenomena have interesting theoretical implications. Firstly, they make it clear that # boundaries can indeed be replaced at two different points in the cycle. Secondly, we can speculate that rather than having two separate #- replacement rules in the grammar, it would be more correct to consider speakers as having two alternate grammars available to them. If, for example, a speaker uses rule 2 on a verb, he is in effect using a grammar without any rule 19, as this latter rule has been absolutely bled by rule 2. The choice of which grammar to use would generally depend on whether or not the word in question is a verb, but could be influenced by other factors. Our present description, however, is reasonably accurate and accords with customary formalism.

In conjunction with the five-syllable adjustment rule, we can present the rule for replacing ## boundaries, as the ordering considerations

are critical. After the word-level cycle, all internal # boundaries have been replaced but ## boundaries must remain, as these are required by rule 9 (see example (25)). However, as we have seen, rule 11 must not be allowed to operate after the word-level cycle, so presumably these boundaries are replaced before we reach rule 11 on this next cycle. The rule replacing ## boundaries must therefore come after rule 9 and before rule 11. Moreover, the ## boundaries are string-internal when this rule applies.

rule 10 ## $\longrightarrow$. /[+seg]___ [+seg]

In a fuller description we would need to allow rule 10 to generate pause boundaries in appropriate circumstances. We can, however, disregard pauses for our present purposes as they do not affect stress except in interjections, which always have a pre-pause stress. As we are not attempting a description of interjections here, we will also ignore pauses.

2.4.5 PRIMARY STRESS

The normal situation is for primary stress to fall on a syllable already specified as [2 stress]; therefore the basic form of our primary stress rule is [2 stress] $\longrightarrow$ [1 stress]. The syllable to which this applies is the final [2 stress] syllable in the stem of the word. A compound stem behaves as a single long stem, and so does a stem formed by the addition of some kind of derivational suffix to another stem. We will discuss this question and other related matters in section 3.1; the approach we will suggest there is that by the time the cyclic rules apply, any internal bracketing and boundaries within brackets labelled STEM will have been deleted, so that every word will have just one stem.

(rule 17) [2 stress] $\longrightarrow$ [1 stress] / ___ X (#)] STEM

where X is any string not containing [1 stress] or [2 stress].

There is one exceptional situation regarding primary stress assignment, for which we will need separate rules. If a stem consists of a single S, it will not have been assigned [2 stress] as it does not form a stress group. In this case, however, the syllable still received primary stress. This, as we might expect, necessitates a subsequent adjustment so that a stress group is formed. The adjustment is simply that the syllable becomes long. The one situation where this does not occur is where a single S suffix is present; rule 7 joins this to the stem to form a stress group, removing any need for a subsequent adjustment.

(40)

["muun]	/mun/	'foot'
['ana."muun]	/ana#mun/ PRF-foot	'the foot'
[a"munduj]	/a#mun#rruj/ PRF-foot-at	'at the foot'

In these examples I have used phonetic brackets, since the orthographical form of 'foot' is simply *mun*. This reflects the fact that the underlying form of this word is short, as can be seen when an S suffix is added or when the word if formed into a compound, as in

(41) ['wumun.'bulal.'wula."linyung]

/ wu#mun+wulalwulal#yinyung/ 'four-footed thing'
it-foot- four - REL

In contrast, there are single-syllable stems which retain their length under compounding, so I assume these have underlying length:

(42)

[yaal]	/yaal/	'mental state'
[yaal.'ngala."ngalij]		
/yaal+ngalangalij/		
mental.state - tricky		'tricky'

For single S stems, we cannot formulate a single rule to cover primary stress assignment and lengthening, since the former must take place on the stem-level cycle, while the latter must wait until there has been an opportunity for any S suffix to be joined on by rule 7 to form a stress group; this will be on the word-level cycle. For the first rule, therefore, we have

(rule 18) $\left[-\text{ stress}\right] \longrightarrow [1\text{ stress}] / \#\ \left[\overline{\text{S}}\right]_{\text{STEM}}$.

The second rule must lengthen any S carrying [1 stress] that is immediately followed by a boundary:

(rule 8) $\left[1\text{ stress}\right] \longrightarrow [+\text{long}]\ \left[\overline{\text{S}}\right]\ [-\text{seg}]$

2.4.6 RULES RELATED TO PRIMARY STRESS

We will deal here with three processes that are dependent on the position of primary stress in the word. The first two of these are closely related. Their function is apparently to prevent word initial stress and primary stress falling on adjacent syllables;

this can occur where the first of these two syllables is long. There is normally no restriction on a long stressed syllable being followed immediately by another stress, whether primary or secondary. In this one situation, however, this does not occur unless a # boundary intervenes. (We will discuss this shortly.) Where the stressed S· is preceded by an S in the same stress group (i.e. where rule 3 has operated to join this S to the stress group on its right), stress is transferred from the S· to that preceding S. Thus S'S·."S . . . is converted to 'SS·."S . . . This process is optional - it appears to apply around half the time. I have not been able to determine any conditioning factor, except that in rapid speech it may occur somewhat less often (which might be expected as we will see shortly). I have recorded instances of the same speaker pronouncing the same word on two occasions, in one case only a few minutes apart, in a similar surrounding environment, where one one occasion this process has occurred and on the other occasion not.

Before giving examples, we will indicate what occurs when the above process could have occurred but did not. In this situation the primary stress itself shifts on to the preceding S·, and the syllable formerly carrying primary stress becomes unstressed. In the case of a word of form 'S·."SS, where the S· is not preceded by another S, the former process cannot operate, so the latter one always does, yielding "S·SS. Notice here that we are assuming that the stress group boundary is deleted, as otherwise this word would contain a 'stress group' with no stress. We will return to this point shortly.

(43)	'aynjaa."bugij ~ a"ynjaabugij	'one'
	'ngalaa."ligi ~ nga"laaligi	'turtle'
	'ngarraan."bana ~ nga"rraanbana	
	/ngarra#anbana/	
	PRF - rain	'the rain'
(44)	"maalamburrg	'proper'
	"daabulu	'small goanna'
	"wuubani	'that (ANA class, non-nominative)'

The first of each pair of examples (43) show the result of the first process, where the word-initial stress is shifted; the second of each pair as well as examples (44) illustrate the second process, where the primary stress is shifted.

Returning to the question of the deleted stress group boundary in these latter examples, we have further evidence in that, as a general rule, the time taken to pronounce words such as these is usually about

the same as for stress groups in the same utterance, while as we mentioned earlier, neighbouring stress groups are normally of approximately equal duration.

(45) "waari.nga"rraanbana.ngi'yarra.ra"bini

/##waari##ngarra#anbana##ngi#warra#rabi+ni##/

not PRF - rain it-all -fall-PAST.2

'no rain fell'

In this utterance all the stresses are approximately evenly spaced in time, this being the normal pattern. The stress groups are thus nearly equal in duration, along with the word ngarraanbana. It therefore does appear that this word constitutes a single stress group.

This provides a motivation for the fact we mentioned earlier, that for examples such as (43), the first process applies somewhat less often in rapid speech. This process results in two stress groups (as in the left-hand set of examples (43)), while the second process (which applies where the first does not) results in only one stress group.

Another conclusion we may draw from these facts is that the 'long' syllables in these examples where two stress groups have coalesced are etically not long at all. A long syllable normally occupies a whole stress group, sometimes with a short syllable present as well, while these stress groups have two or three short syllables packed into the same stress group. We are regarding this shortening as a surface detail only; we could argue as well that the short syllables have been made even shorter. We will not cover these details in the rules.

In formulating a rule to describe the first process, we face several choices. This process, which fronts the stress on a word-initial SS· stress group, is tantalisingly similar to rule 9 which fronts the stress on an SSS stress group under very similar conditions. If we extend rule 9 to cover SS· stress groups, we will still need to deal with the fact that this fronting is optional (or at least, does not always appear on the surface), as well as the fact that it only occurs where a [1 stress] follows — a condition not otherwise needed in rule 9. Alternatively, we could let rule 9 apply to all word-initial SS· stress groups indiscriminately, and write a new rule to retract the stress to the S· except under the particular condition that a [1 stress] follows, in which case this rule would be optional. At this point it appears that we are adding unnecessary complexity in an attempt to capture a generalisation, and so we propose to leave rule 9 unchanged and simply write a separate rule to front the stress (optionally) on a word-initial SS· stress group, when a [1 stress] follows.

(rule 14) [-stress] $\longrightarrow$ [2 stress] /# $\left[\overline{\text{S}}\right]$ S·. [1 stress] (optional)

The second process we described above must apply to all strings of form #S·[1 stress], as well as to all strings on which rule 14 could have applied, but did not. We may therefore formulate this rule thus:

(rule 15) # (S) S· .[1 stress] $\longrightarrow$ 1 2 $\begin{bmatrix}3\\1\ \text{stress}\end{bmatrix}$ Ø $\begin{bmatrix}5\\-\ \text{stress}\end{bmatrix}$
1 2 3 4 5

Note the deletion of the stress group boundary, which we discussed previously.

In considering the ordering of these rules with respect to the other rules, we must look at several facts. Firstly, the # boundary following prefixes (except for pronominal prefixes on verbs) must have been removed before the rules apply. Thus

(46) /na#ngalaaligi/ 'the turtle'
PRF- turtle

yields, not *na.'ngalaa."ligi or *'nanga."laaligi, as we might expect if rule 14 or 15 respectively had applied to the string #ngalaaligi. Rather, we find

(47) 'nanga.'laa."ligi

which is what we would expect if neither rule applied. Presumably, then, the # boundary has already been removed by rule 2 before we arrive at rules 14 or 15, so that their environmental conditions are not met. Thus these rules do not apply on the stem-level cycle, in which primary stress is assigned, but on the subsequent word-level cycle, after rule 2 has removed any # boundary between a prefix and the stem. These rules should therefore *precede* the primary stress rules in the rule ordering, so that they have no opportunity to operate before the subsequent cycle. (An alternative approach would be to include ## in the environment for these rules, to force them to operate on the word-level cycle only. This ordering constraint would then not apply.)

We find, however, that in the case of verbs, the # boundary following the pronominal prefix must still be present at the time these rules operate. As we have seen, this boundary must be retained longer than other # boundaries. Thus we have

(48) 'nimba."maa<u>l</u>amburr.'gana
/nimba#maa<u>l</u>amburrg#wa+na/
you/me-proper- FACTITIVE-NONPAST.2
'do the right thing for me'

This is a verbal construction, based on an adjective stem, and nimba- is a pronominal prefix. We can see that rule 15 has applied. We take it, then, that rule 15 must precede the rule replacing the # boundary following a pronominal prefix. I have no examples to directly prove this for rule 14, however it is clear in any case that rule 14, which bleeds rule 15, must precede it.

Consistently with this, if we have a string of form ##(S)S·#"S... where the S· is the result of vowel elision between a pronominal prefix and a stem-initial vowel, rules 14 and 15 do not apply. Presumably they are blocked by the # boundary remaining after the S·. (It is on the basis of words such as this that we are asserting that the vowel-elision rule, rule 1, moves any intervening boundaries to the right of the resulting S·.)

(49)	'baa."nina	/ba#ani +na/ you-come-NONPAST.2	'come here!'
	a'nii."gina	/ani#agi+na/ he-return-NONPAST.2	'he will return'

When we reach rules 14 and 15 on the word-level cycle, we have for these words ##'baa#"nina and ##a'nii#"gina respectively.

We will also need to ensure that for such words, rules 14 and 15 cannot apply on the *subsequent* cycle, when # boundaries following the pronominal prefixes have been removed. This can be done simply by ordering these rules after rule 10 which replaces ## boundaries. Both rules have # in their structural descriptions and once rule 10 has applied during the cycle in question, there are no such boundaries left. (Again, alternatively, if we included ## in the environment for these rules, this ordering constraint would not apply.)

It is these two rules, along with the five-syllable adjustment rule (rule 11), that provide the clearest evidence for the retention of # boundaries following pronominal prefixes on verbs, until late in the word-level cycle.

We should note, however, that while what we have described here is the normal situation, on occasions rule 15 can apply where we might expect it to be blocked by a # following a pronominal prefix. Thus on occasions we can have forms such as "baanina (compare the normal situation (49)). We can analyse such forms by regarding rule 2, which replaces most # boundaries, as having applied to verbs as well — we discussed this point in section 2.4.4 above. The conditioning factor here appears to be speed of speech. This is reasonable, for where rule 15 applies, it reduces the number of stress groups by one. As stress groups normally occupy approximately equal time intervals, there is motivation for any process that would reduce the number of stress groups in rapid speech.

The third process related to primary stress is a minor one in that it occurs only in one quite specific situation — where the primary stress is preceded by an S· with the same segmental form, which is not in the initial stress group of the word. This syllable loses its length and stress. This may not occur at artificially slow speech speeds. The syllable with primary stress may be long or short.

(50)	[a'niij.'gala."laadi]	/ana#ij+gala#alaadi/ PRF-thing-RDP-bad	'bad things'
(51)	['malga.dha"dharri]	/malg#adhaadharri/ time - after	'later on'

with (51), compare

(52)	'adhaa."dharri ~ a"dhaadharri	'after'

In (52), the S· is in the initial stress group of the word, so that the word becomes a candidate for rules 14 or 15 rather than the process we are describing here.

The following rule describes this process:

(rule 16) $C_1 \begin{bmatrix} V_1 \\ +\text{long} \\ 2\ \text{stress} \end{bmatrix} \cdot \; C_1 \begin{bmatrix} V_1 \\ \text{stress} \end{bmatrix} \cdot \longrightarrow 1 \begin{bmatrix} 2 \\ -\text{long} \\ -\text{stress} \end{bmatrix} \; \emptyset\ 4\ 5\ 6$

1 2 3 4 5 6

Here we have specified that the S· carries 2 stress, as this is the simplest way of ensuring that this syllable is not in the word-initial stress group. If it were, rule 14 or 15 would have operated to change this stress. Of course, this approach requires that this rule be ordered after rules 14 and 15, but before the primary stress rule (rule 17). If it followed the latter rule, it could operate on the previous cycle to rules 14 and 15.

We have also specified that the . following the S· is deleted, as this accords with the observed output. (In (50), resegmentation has occurred on the following cycle, converting [a'niij.gala"laadi] to [a'niij.gala."laadi], leading to the required output [a'niij.'gala."laadi].)

We have specified the S· and the primary stressed syllable as being of form CV, as this is so far the only form in my data. If it turns out that the rule should apply to CVC syllables as well, it can be appropriately modified.

2.5 RULE SUMMARY

We will list all the rules in order, then in the next section we will discuss the rule ordering. The rules are not changed in any way from the previous section, but they are all named.

(1) Vowel Elision

$$V \left(\left\{ \begin{matrix} \# \\ \cdot \end{matrix} \right\} V \right) \longrightarrow \begin{bmatrix} 1 \\ + \text{ long} \end{bmatrix} \; 2 \; \emptyset$$

1 2 3

(2) Word Boundary Metamorphosis 1

$$\# \longrightarrow \; . \; / \; [+\text{seg}] \_\_ \; X \; \#]_{NV}$$

where X = any string

NV = any grammatical category except VERB.

(3) Rightward S Joining

$$[-\text{seg}] \begin{bmatrix} S \\ \alpha \text{ stress} \end{bmatrix} \; . \; C \begin{bmatrix} V \\ \beta \text{ stress} \end{bmatrix} \longrightarrow 1 \begin{bmatrix} 2 \\ - \text{ stress} \end{bmatrix} \; \emptyset \; 4 \; 5$$

1 2 3 4 5

unless $\alpha = 1$ and $\beta \neq 1$.

(4) Long Syllable Segmentation

$$\emptyset \longrightarrow \; . \; / \left\{ \begin{matrix} [+\text{seg}] \_\_ \begin{bmatrix} S\cdot \\ - \text{ stress} \end{bmatrix} \\ \begin{bmatrix} S\cdot \\ - \text{ stress} \end{bmatrix} \_\_ \; [+\text{seg}] \end{matrix} \right\}$$

(5) Closed S segmentation

$$\emptyset \longrightarrow \; . \; / \; C \_\_ \; C \; V \; S$$

(6) Pairwise S Segmentation

$$\emptyset \longrightarrow \; . \; / \; [-\text{seg}] \begin{bmatrix} S \\ - \text{ stress} \end{bmatrix} \begin{bmatrix} S \\ - \text{ stress} \end{bmatrix} \_\_ \; [+\text{seg}]$$

(7) Leftward S Joining

$$. \longrightarrow \emptyset \;/\; \_\_ \begin{bmatrix} S \\ -\ \text{stress} \end{bmatrix} [-\text{seg}]$$

(8) S Stem Lengthening

$$\begin{bmatrix} 1\ \text{stress} \end{bmatrix} \longrightarrow [+\ \text{long}] \;/\; \left[\overline{\overline{S}}\right] [-\text{seg}]$$

(9) Word Initial SSS Stress Group Initial Stress

$$[-\ \text{stress}] \longrightarrow [2\ \text{stress}] \;/\; \#\ (S.) \left[\overline{\overline{S}}\right] \begin{bmatrix} S \\ \alpha\ \text{stress} \end{bmatrix} S\ [-\text{seg}]$$

where α = - or 2.

(10) Full Word Boundary Metamorphosis

$$\#\# \longrightarrow .\ /\ [+\text{seg}]\ \_\_\_\ [+\text{seg}]$$

(11) Five-Syllable Adjustment

$$\#\ S\ S\ S\ .\ [1\ \text{stress}] \longrightarrow 1\ 2\ 3\ 5\ 4\ 6$$

1 2 3 4 5 6

(12) S S S Stress Group Medial Stress

$$[-\text{seg}] \begin{bmatrix} S \\ \alpha\ \text{stress} \end{bmatrix} S\ S\ [-\text{seg}] \longrightarrow 1\ 2 \begin{bmatrix} 3 \\ \alpha\ \text{stress} \end{bmatrix} 4\ 5$$

1 2 3 4 5

where α = 1 or 2.

This rule does *not* apply if the stress group has the form

$$C_1\ V_1\ C_2\ V_2\ C_3\ V_3\ (C)\ (C)$$

and one of the following conditions holds:

(a) V_2 = i and C_3 = y.

(b) $V_1 = V_2 = V_3$ and C_2 = rr.

(c) $V_1 = V_2 = V_3$ = a or u, and C_2 = g, ngg or ng, unless C_2 = g and C_3 = y,w, rr or r.

(13) Stress Group Normal Stress

$$[-\text{ stress}] \longrightarrow [2\text{ stress}] \Big/ [-\text{seg}] \left(\begin{bmatrix} S \\ -\text{ stress} \end{bmatrix} \right) \left(\left\{ \begin{matrix} [\overline{S}] \\ [\overline{S}\cdot] \end{matrix} \right\} S \right)$$

(14) Pre-Primary Stress Shift

$$[-\text{ stress}] \longrightarrow [2\text{ stress}] \;/\; \# [\overline{S}]\; S\cdot .\; [1\text{ stress}] \qquad \text{(optional)}$$

(15) Primary Stress Shift

$$\underset{1}{\#}\ \underset{2}{(S)}\ \underset{3}{S\cdot}\ \underset{4}{.}\ \underset{5}{[1\text{ stress}]} \longrightarrow 1\ 2 \begin{bmatrix} 3 \\ 1\text{ stress} \end{bmatrix} \emptyset \begin{bmatrix} 5 \\ -\text{ stress} \end{bmatrix}$$

(16) Pre-Primary Stress and Length Deletion

$$\underset{1}{C_1} \begin{bmatrix} V_1 \\ +\text{ long} \\ 2\text{ stress} \end{bmatrix} \underset{2}{\cdot}\ \underset{3}{C_1} \begin{bmatrix} V_1 \\ 1\text{ stress} \end{bmatrix} \underset{4}{\cdot} \longrightarrow 1 \begin{bmatrix} 2 \\ -\text{ long} \\ -\text{ stress} \end{bmatrix} \emptyset\ 4\ 5\ \underset{6}{6}$$

(17) Primary Stress

$$[2\text{ stress}] \longrightarrow [1\text{ stress}] \;/\; \underline{\quad}\quad X\ (\#)\ ]_{STEM}$$

where $X \neq [\alpha\text{ stress}]$, $\alpha = 1$ or 2

(18) S Stem Primary Stress

$$[-\text{ stress}] \longrightarrow [1\text{ stress}] \;/\; \# \left[\overline{S}\right] (\#)\ ]_{STEM}$$

(19) Word Boundary Metamorphosis 2

$$\# \longrightarrow . \;/\; [+\text{seg}]\ \underline{\quad}\ [+\text{seg}]$$

2.6 RULE ORDERING

We have already dealt with rule ordering to some extent in our discussion of the individual rules. This was necessary, as in many cases a change in the formulation of a rule could be made if there was also a change of order. Even given our chosen formulations, however, the order in which the rules are given is only one possible ordering. For most of the rules, various other rules are independent

and could equally well precede or follow the rule in question, while other rules must precede or follow it as the case may be. We will now briefly look at the rules from this point of view.

Rule 1 (Vowel Elision) must precede rule 4 (Long Syllable Segmentation) which it feeds. Rule 1 is independent of rules 2 and 3.

Rule 2 replaces # boundaries except in verbs. It must precede rule 3 (Rightward S Joining) which it feeds. Note that rule 2 cannot operate on the first cycle, as the # it replaces must be string-internal. This guarantees that rule 3 cannot operate on the first cycle, which we require (see our discussion of example (25) in section 2.4.3). For the same reason, rule 3 must precede rule 5 which could otherwise feed it on the first cycle. Rule 5 is independent of rules 1 and 4. Rule 6 (Pairwise S Segmentation) must follow rules 4 and 5 which feed it by providing . boundaries to which rule 6 is sensitive.

Rule 7 (Leftward S Joining) is fed by rule 2 and rules 4 to 6, and must therefore follow these rules, regardless of how they are ordered. Rule 7 bleeds rule 8 and feeds rules 9, 11, 12 and 13; it must therefore precede all these rules.

Rules 9 to 13 must come in that order. The rules assigning stress (rules 9, 12 and 13) are mutually dependent — rule 9 feeds rule 12, which in turn bleeds rule 13. Rule 11 (Five-Syllable Adjustment) must follow rule 9 (which sets up the required stress pattern) and precede rule 12 (which can change it). If rule 11 were reformulated to assign stress, it could follow rule 12 and, indeed, it could come at any later point in the cycle. It could not, however, come any earlier, for rule 10 (which replaces ## boundaries) must follow rule 9 and precede rule 11 — we discussed this point in detail in section 2.4.4. If rule 11 were reformulated and placed later in the cycle, rule 10 could also come later, so long as it still preceded rule 11.

Rules 14 to 16 deal with processes related to primary stress. As we saw in section 2.4.6, these rules must come in that order and precede rule 17 (Primary Stress). They could come earlier in the cycle, however; it is only necessary for them to follow rule 2 (which bleeds them, replacing some # boundaries).

Rule 17 (Primary Stress) is fed by the earlier stress assignment rules (9, 12 and 13), as it converts a [2 stress] to a [1 stress]. It must therefore follow these rules. It must also follow rules 14 to 16, as we have just seen; however, as these rules could be placed before rule 9, either of these ordering constraints could be significant. Neither of the following rules in the cycle depend on rule 17; this rule could therefore follow either of them.

Rule 18, which assigns primary stress to stems consisting of a single S, is independent of every other rule in the cycle and so could be placed anywhere.

Rule 19 removes # boundaries following pronominal prefixes. Since rules 11, 14 and 15 require these boundaries to be present, rule 19 must follow them.

2.7 ORDERING WITH RESPECT TO OTHER PHONOLOGICAL RULES

J. Heath in his work on Nunggubuyu (Heath, forthcoming) gives 50 phonological rules. These are non-cyclic and do not deal with stress. As a broad generalisation, it appears that these rules should operate before the cyclic rules, or at least before any segmentation begins (rule 4). Many of the rules do not affect syllabic structure at all and so are irrelevant to us here. For those that do affect syllabic structure, however, as far as I can tell, the correct output is obtained if the stress rules operate on the output of these rules. One example is vowel elision, which we have given in a simplified form as rule 1. Another example is Heath's Nasal Assimilation rule, which must be ordered very late among his rules. This rule, where it operates, assimilates nasals to the point of articulation of a following stop. As we have shown, the output of such a rule ought to be (for stress-group segmentation purposes, at least) a unit phoneme, a prenasalised stop. This rule, too, must therefore operate before our rule 4.

There is just one apparent exception which we will need to look at here. Heath gives a rule, Monosyllable Lengthening, which corresponds to our rule 8. The correspondence, however, is not exact in that Heath claims his rule does not apply to certain stems. Moreover, he orders this rule before his Reduplication rule while, in the light of our general statement above, reduplication ought to be performed before any of the cyclic rules apply. We will look at both these points of difference in turn.

The stems which Heath claims are not lengthened are verb stems of the form CVC, and perhaps also noun stems of form CVCC. I would claim that all such stems are lengthened, so that we have

(1) ['bawu."maang] /bawu#ma+ng/ 'you will get it'

you/it-get-NONPAST.1

Without lengthening, we would expect either * [ba"wumang] or else, on the principle that a stem must carry primary stress, *['bawu."mang]. This latter alternative has an otherwise unattested stress group of a single stressed S; where another word followed

without a pause, its initial stress would follow too closely in time to the preceding stress. It is possible that the reason for Heath's assertion is that pre-pause length distinctions are often hardly manifested by (etic) length differences at all, but by *stress* differences. Word-final short syllables (on our analysis) are never stressed, while long syllables always are. In pre-pause position we do appear to have a case of 'displaced contrast', with the underlying length distinction actually being carried largely by stress. This difficulty can be compounded if a hearer is listening for *vowel* length in a closed syllable, rather than syllable length.

The evidence that Heath presents for his ordering of Monosyllable Lengthening before Reduplication, is that when an S stem undergoes reduplication both components are lengthened, as in

(2) [nilhaalhaay] /ni#lha#lha+y/

he-RDP-stand-PAST.2

'he was standing for a long time'

While there are several verbs (such as this one) with single S stems, Heath (and I) can find only one noun/adjective stem of this type which also permits reduplication.[5] This is *yilg* 'silly'. While Heath writes this stem with a 'short vowel', I would claim, in line with the remarks above, that it is subject to lengthening by rule 8. However (and here we agree with Heath) when reduplicated, the reduplicative syllable is short.

(3) [yi"yiilg] /yi#yilg/ 'silly ones'

RDP-silly

or, with prefix:

(4) ['warra.yi"yiilg] /warra#yi#yilg/ 'the silly ones'

PRF -RDP-silly

On Heath's assumption that both the stem and reduplicative syllable are short, his rule ordering gives the simplest analysis, as the length of the reduplicative syllable is in all cases the same as that of the syllable being reduplicated, after Monosyllable Lengthening has had a chance to apply. On our analysis, however, the lengths do not agree in the case of the one noun stem for which a determination is possible. The approach we will take is that this length discrepancy results from the fact that it is a noun rather than a verb stem, and is thus related to the point in the cycle at which # boundaries are replaced. This approach may appear somewhat arbitrary, being based on a single example, yet it is consistent with our overall analysis. We now find that provided we make certain assumptions about the bracketing that results when a string undergoes

reduplication, our rules will yield the correct output if reduplication is handled before any of the cyclic rules. Consider first the verbal example (2). We assume that on input to the phonological component the string has the form

(5) [# ni#RDP [# lha + y] #] .
VERB STEM STEM VERB

(We will discuss in section 3.1 our reasons for including the PAST.2 suffix -y within the STEM brackets.) The reduplication rule, triggered by the symbol RDP appearing in the string, will yield

(6) [# ni[# lha] [# lha + y] #]
VERB STEM STEM STEM STEM VERB

(We will discuss the form of reduplicated strings in more detail in section 3.1.) On the first pass of the transformational cycle, rule 18 will assign primary stress:

(7) [# ni[# "lha] [# "lhay] #]
VERB STEM STEM STEM STEM VERB

At the end of this cycle, the STEM brackets are deleted.

(8) [# ni # "lha # "lhay #]
VERB VERB

On the next cycle, as the string under consideration has a bracketing labelled VERB, rule 2 does not replace any # boundaries. Rule 8, S Stem Lengthening, now applies twice

(9) [# ni #"lhaa#"lhaay#]
VERB VERB

leading eventually to the correct output

(10) [ni"lhaa."lhaay] .

Consider now the single noun example (4). Here the derivation parallels the example we have just considered, up to the point where the STEM brackets are deleted (cf. (8) above):

(11) [# warra # " yi # " yilg #]
NOUN NOUN

On the next cycle, rule 2 replaces the string-internal # boundaries:

(12) [# warra. "yi."yilg #]
NOUN NOUN

Rule 3 now joins the reduplicative syllable to the right and removes its stress.

(13) [# warra.yi"yilg#]
NOUN NOUN

Rule 8 now applies, but this time only once

(14) [# warra.yi"yiilg#]
NOUN NOUN

which leads to the correct output

(15) ['warra.yi"yiilg]

3. RELATED TOPICS

3.1 # AND + BOUNDARIES

As we have seen so far, on entry to the transformational cycle a # boundary must separate prefixes and most suffixes from stems. Other suffixes, notably tense suffixes on verbs, we have separated by + boundaries and also we have put + boundaries between the components of compound stems. We will now discuss this question in more detail.

The readjustment rules (Chomsky and Halle 1968:13) take the string as output from the syntactic part of the grammar and prepare it for input to the phonological rules. This readjustment component will rewrite certain # boundaries as +, depending on grammatical considerations. We will look at some of these here, although a full treatment would require further study.

Many inflectional suffixes on verbs consist of a C, a V, or a VC. These forms always combine with the final syllable of the stem. For other inflectional suffix forms I do not so far have data that could clearly distinguish the nature of the boundary. This is largely because stress group segmentation basically proceeds from left to right, so that for the vast majority of verbal forms we arrive at the same stress pattern regardless of the boundary type. However, we do have evidence in the way the Nunggubuyu reduplication rule handles verbal forms, as Heath (forthcoming, chapter 3) states: ' ... the stem available for duplication ends with the final segment of the inflectional suffix in the case of verbs.' This point is one where we would definitely regard a # as being present. Thus it appears most probable that inflectional suffixes on verbs are marked off with a + boundary, as are derivational suffixes (such as Reciprocal -ynji-) which can occur between the stem and the inflectional suffix. (We will take this point up again shortly.)

For compound words the situation is clearer. In section 2.4.2 example (4), we presented a long compound word that segments as if it were a unit:

(1) bira + ngarrdha + ngàrrdha + nga + j + yinyung

which yields

(2) bi'rangarr.'dhangarr.'dhanga."jinyung

If the + boundaries had been #, rule 2 would first replace the # boundaries

(3) * bira.ngarrdha.ngarrdha.nga.jinyung

(assuming the last two morphemes have already been joined by the non-cyclic hardening and geminate contraction rules).

This would eventually give

(4) * 'bira.'ngarrdha.ngarr'dhanga."jinyung

Notice also the position of primary stress in the actual output (2). The morpheme -yinyung performs a variety of functions; here apparently it is functioning as a relative marker, converting a verb into a noun in association with the nominaliser -j-. The basic root is *-ngarrdha-* 'to be high'. From our treatment of primary stress, it would appear that this whole compound word is functioning as a single stem. Indeed, I have found no evidence for regarding any word as having more than one stem on input to the phonological component. One apparent exception is the case of a single S stem which is reduplicated, as we discussed in the previous section. Reduplication, however, is a phonological rule, so we assume that it remains true that on input to the phonological component we have only one stem. We will discuss reduplication in more detail shortly.

As we indicated above, derivational suffixes which can be interposed between a verb stem and an inflectional suffix should probably be marked off with + boundaries, on the basis of the way the reduplication rule handles such forms. Primary stress placement suggests the same conclusion. Thus we have

(5) 'wurru.'wiynji.wi"ynjini

/wurru#wiynji#wi+ynji+ni/ 'they kept hitting each other'

they - RDP -hit-RECIP-PAST.2

Here the primary stress falls on the Reciprocal suffix -ynji-; so this morpheme along with the PAST.2 -ni should be included within the STEM brackets. These points are perhaps not conclusive in proving that the boundaries in question are + instead #; we would

like to be able to demonstrate this from the stress pattern, but this cannot be done for this example — either boundary type yields the same pattern. I do not yet have data which would allow the boundary types in this situation to be determined from stress patterning alone.

We find a similar situation with regard to derivational prefixes on nouns. Consider

(6) wu"ngugi /wu + ngu + gi/ 'dirty thing'
DERIV-EPEN-dirt

Here the basic root is -gi, but the primary stress has fallen on the epenthetic morpheme -ngu- (inserted by a non-cyclic phonological rule). The readjustment rules presumably yield the string

(7) [# wu + gi #]
STEM STEM

Here again we would like to find data to prove clearly from stress patterning the nature of boundary between the morphemes; this however would require a one-syllable derivational prefix to be placed on a five-syllable stem or longer.[6] However, once again the reduplication rule provides corroborative evidence. J. Heath (forthcoming) has found that the ANA class derivational prefix /uD-/[7] co-occurs with reduplication in a very few cases, and there it is included in the reduplicative segment:

warrumuumuwaj /warra#umu#uD+muwaj/ 'their name (human plural)'
PRF -RDP-DERIV-named

(Here the process whereby warra#umu . . . yields warrumu . . . is not the regular elision process described by rule 1, as a short syllable results. This point is not relevant to us here. The essential point is the inclusion of the derivational morpheme -uD- within the string undergoing reduplication.)

From what we have seen so far, I would tentatively propose a theory that the readjustment rules for Nunggubuyu should delete any bracketing nested within brackets labelled STEM, and replace all instances of # between these brackets by +. The stem should include derivational prefixes on nouns and derivational and inflectional suffixes on verbs.

Next, we will look at another type of affixation which occurs in verb morphology. There are a variety of morphemes which can be placed between a pronominal prefix and the verb stem proper. What is the nature of the intervening boundaries?

Consider

(8) ngi'yarra.ngu'bujurr."bujurr
/ngi#warraD#ngu#bujurrbujurr/
she-many-EPEN -having.sores 'she had sores all over'

(9) ni'yarra.ngu'duwuḻ."wini
/ni#warraD#ngu#duwuḻwi+ni/
he-many-EPEN- dance -PAST.2 'he did many dances'

Example (8) is a verbal construction, based on an adjective stem. This kind of construction is quite regular. Example (9) is a plain verb. In both cases there is a compounding prefix, *-warraD-* 'many'. (Here D stands for an unspecified stop which is deleted on the surface and whose only function is to trigger, in these cases, -ngu- epenthesis. The details need not concern us here.)

We will show from these examples that the second and third boundaries must be #, not +. Taking example (9), if we had */ni#warraD+ngu+duwuḻwini/ the string following the # would segment as a unit, then later the prefix would join to the right. The result would be *ni'yarra.'ngudu.wuḻ"wini. If we had */ni#warraD#ngu+duwuḻwini/ the same output would result and */ni#warraD+ngu#duwuḻwini/ would lead to *'niya.'rrangu.'duwuḻ."wini.

We cannot prove from these examples that the # boundaries are retained until rule 19, rather than being replaced by rule 3. This, however, is presumably true for the # following the pronominal prefix, and it does yield the correct output (as well as giving the simplest analysis) to assume that all the # boundaries are retained.

We are taking it, then, that the derivation for example (9) is as follows:

(10) ni#warraD#ngu#duwuḻwi+ni
→ ni#yarra#ngu#duwuḻwini (Certain non-cyclic rules)
→ ni#yarra#ngu#'duwuḻ."wini (stem-level cycle)
→ ni.'yarra.ngu.'duwuḻ."wini (word-level cycle)
→ ni'yarra.ngu'duwuḻ."wini (rule 3)

We will now look at an example of noun incorporation within a verb:

(11) 'wungunu.nga'gara.waḻ"gaa
/wungunu#ngagara#waḻga+a 'those two women crushed his bones'
they(FDu)/him-bone-crush-PAST.2

Here it is quite clear that if either # boundary were a + boundary instead, the segmentation rules would produce the wrong number of stress groups. We can take it, then, that we do not have a compound stem */ngagara+walga+a/ but rather a situation similar to that in the examples we have just been considering. This is not merely a result of our decision to have only + boundaries within stems; if the string were

```
* [#    wungunu [#    ngagara#walga+a]    #]
   VERB          STEM                STEM   VERB
```

we would obtain for the stem on the first cycle, first

*ngagara.walgaa (rule 2), then *ngaga.ra.wal.gaa (rules 4 and 6).

Rule 7 would convert this to *ngagarawal.gaa, which would resegment on the next cycle to *ngaga.rawal.gaa. We would obtain as the final output *'wungunu.'ngaga.'rawal."gaa. We take it, then, that the string should be specified as

```
(12) [#     wungunu#ngagara [#    walga + a]     #]
      VERB                  STEM           STEM    VERB.
```

Finally, we will look at reduplication. This can occur on both verbs and nouns and the form of the reduplicative segment is phonologically determined, with only a very small number of exceptions. We need not go into the details of the reduplication rule here, except to say that most often it yields an SS reduplicative segment, with S·S being a possibility if the stem begins with an S·. Such a reduplicative segment always forms a stress group and would always do so no matter what boundary we place between it and its stem. Where the stem begins with a vowel, the reduplicative segment always ends with a vowel and elision occurs, again obscuring the nature of the boundary. With some stems, however, the reduplicative segment is a single S and here the situation is clearer.

```
(13) 'wingi.bu"burri
     /wingi#bu#burri/                    'The two women sat and sat'
     They(FDu)-RDP-sit(PAST.2)

(14) 'warra.dhu'dhuda."bada
     /warra#dhu#dhudabada/               'the white men'
     PRF   -RDP-  white.man
```

We can see here that in the case of both a verb (13) and a noun (14), the reduplicative syllable has joined the stress group to its right. (If it had joined to the left, an initial S'SS stress group would

have resulted.) For (13) we would obtain the correct output if we treated the reduplicative syllable plus stem as a single compound stem, with only a + boundary intervening. This would not work for (14), however, as the result would be *'warra.'dhudhu.da"bada. For this example it appears that the stem must be dealt with first, then the reduplicative syllable joined to the right. Note also that five-syllable adjustment has not occurred, so presumably at the point where the reduplicative syllable joins to the right (rule 3) the # to its left has already been replaced, as otherwise the five-syllable adjustment rule (rule 11) would be triggered on the same cycle. I propose, then, that the string should be specified as

(15) [# warra#dhu [# dhudabada] #]
NOUN STEM STEM NOUN

In the case of a single S stem undergoing reduplication, as we saw in section 2.7, the STEM brackets are reduplicated as well:

(16) [# warra [# yi] [# yilg] #]
NOUN STEM STEM STEM STEM NOUN

We will now look at the case of certain apparent reduplications such as

(17) wa'dana.wa"dana 'bird species'

There are a number of words of this form. They do not conform to the synchronic reduplication rule, yet somehow we must account for the fact that the segmentation is as it is, and not *'wada.'nawa."dana. I propose to handle such words by regarding them as being stored in the lexicon with a # boundary and a bracketing such as

[# wadana [# wadana #] #]
RDP STEM STEM RDP

With such bracketing we can retain our suggested readjustment rule that rewrites all stem-internal # by +. (Waters 1979:117 takes a basically similar approach for certain Djinang words.)

Nunggubuyu morphology is particularly extensive and complex, and as regards boundary types I have been able to deal with only some of the more important areas, and with several of these only tentatively. A great deal more work will be required to give an adequate treatment to this whole question.

3.2 UNSTRESSED WORDS

It is sometimes possible, in rapid speech, for certain words to become completely unstressed and (judging by timing considerations)

included in the stress group to their left. This is fairly common with the particle *nga* 'and', except when it occurs pre-pause.

'nguynju."yaa.'ninga.yu"waani
/nguynju##yaani##nga##yuwaani/ 'as far as from here to there'
same here and there

I have also observed this phenomenon on occasions with some high-frequency demonstratives in certain situations. Without yet attempting a full analysis of this process, which would probably involve discourse considerations, I would suggest that as far as phonology is concerned it could be handled by a rule which operates on the word-level cycle, and which simply deletes all stresses and stress group boundaries in the word in question, as well as the boundary at the beginning of the word. Presumably this rule would be triggered by a particular labelled bracketing. The stress on the preceding stress group, to which the word is joined, would prevent rule 6 from resegmenting the string on the next cycle. Rule 4 (Long Syllable Segmentation) or rule 5 (Closed S Segmentation) would not be so blocked, but as I have not observed the phenomenon to occur where long or closed syllables are involved, there may be no problem here.

3.3 PRENASALISED STOPS

As we indicated earlier, our analysis of homorganic nasal-stop phonetic sequences as unit phonemes represents a departure from previous work on Nunggubuyu. In this section we will look at the reasons for this analysis.

Firstly, it is true that such phonetic sequences, on the surface at least, occur only word medially. This might suggest that they are sequences, with a syllable boundary coming between. If we look at syllable structure, however, it is clear that this analysis is not adequate. There are several attested forms such as

(1) -lhalmbarra- 'to catch fire'

(2) murrmbumurrmbuluj 'hot'

in which we find three adjacent consonantal phonetic segments. As there are no word-initial or final examples of CCC clusters, we have the choice of making syllable breaks after the first or second segment of these sequences, yielding for example -lhal,mbarra- or -lhalm,barra-. However, only certain types of CC clusters are permissible word finally, and therefore presumably syllable finally; in particular, the second member must be either velar or lamino-palatal. Thus lm and rrm in the above examples are not permissible,

so that the syllable break should in each case come after the first C of the sequence. This leaves us with the suspicious nasal-stop sequence being syllable initial. An argument could perhaps be put forward that all such sequences, in underlying form, do in fact end with a velar or lamino-palatal. This is supportable from (1), which is a compound word /-lhaing+warra-/, but many words showing such sequences are not similarly segmentable. The argument is thus conjectural at best.

Another important fact supporting our conclusion is that when native speakers articulate any word with a homorganic nasal-stop sequence syllable by syllable, they never make a syllable break between the two segments; rather, they omit the nasal entirely. This occurs even when the pronunciation of the nasal as the coda of the preceding syllable would in no way violate syllable structure constraints. Thus, nunggubuyu will be pronounced nu gu bu yu, even though *nung would be quite pronouncable - cf. *mung* 'hair'. I therefore conclude that the second syllable, pronounced gu, is the surfact manifestation of underlying nggu, there being a surface constraint preventing the articulation of the nasal segment following a pause. This conclusion is backed up by the existence of at least one word, *gurriya* 'excrement' which with its noun class prefix mana- becomes mananggurriya. In this word we clearly have an underlying ngg which, when word initial, is pronounced g. This is the reason that when we stated above that such nasal-stop sequences occur only word medially, we added the qualifying remark 'on the surface at least'. Such sequences can apparently occur word initially in underlying form.

We conclude, then, that homorganic nasal-stop phonetic segments occur as syllable onsets; there is no evidence that they occur anywhere else, either as syllable codas or across syllable boundaries. There are, however, no unambiguous CC clusters occurring as syllable onsets; CC clusters can come syllable finally but not syllable initially. We must therefore conclude that the suspicious sequences are unit phonemes.

A second line of argument for this position comes from our stress analysis. We have seen that closed syllables induce a following stress group boundary in some circumstances, and that where the first or second syllable of an SSS stress group is closed, the stress group cannot receive initial stress. These facts allow us to determine in some cases whether a syllable is open or closed, if we would otherwise be in doubt. In these cases, homorganic nasal-stop sequences never act to close the preceding syllable. They must therefore occupy the onset of the following syllable, leading again to the conclusion that they constitute unit phonemes.

As an example of open versus closed syllable determination, consider

(3) /jirrij+waynja+waynja +nga+j/

? - RDP -smell -AUG-NOM 'insect species'

The non-cyclic +-deletion and hardening rules yield

jirrijbaynjawaynjangaj

Rule 5 places . after the closed S:

jirrij.baynjawaynjangaj

and the subsequent segmentation rules give

jirrij.baynja.waynjangaj.

Stress assignment gives

'jirrij.'baynja.wa"ynjangaj

which is the correct output. Consider, however, if the phoneme ynj were a cluster, yn followed by j. Rule 5 would now yield *jirrij.bayn.jawayn.jangaj,

which rule 7 would convert to

*jirrijbayn.jawayn.jangaj,

which would lead to

*ji'rrijbayn.'jawayn."jangaj

Consider also the word "*yungguyung* 'in order that'. This word forms an SSS stress group meeting the conditions for initial stress. If, however, nng were a sequence, ng plus g, the first S would be closed and the initial stress conditions would not be satisfied.

Before we leave this question we will briefly compare the findings of two other researchers who have worked in nearby languages with a number of similar phonological characteristics to Nunggubuyu.

R. Wood (1978:94) analyses homorganic nasal-stop sequences in Yuulngu languages as clusters, on the basis of four points:

> (a) The separate medial occurrence of both nasals and stops...
> (b) The absence of prenasalised stops word-initially or finally, where, however, nasals and stops both occur separately . . .
> (c) Occurrences of two of the suspect sequences reversed medially . . .
> (d) The occurrence of heterorganic nasal plus stop sequences...

These arguments are convincing for the languages on which Wood was working; for Nunggubuyu, however, they cannot all be applied. Point (a) holds; it is probably true, however, for most if not all of those languages for which prenasalised stops are acknowledged to exist. Point (b) is true word-finally but, as we have shown, is true word-initially only on the surface, there being one word beginning ngg- in underlying form. Point (c) does not hold for Nunggubuyu; there are no reversed sequences. Point (d) does hold for Nunggubuyu.

Thus, in attempting to apply Wood's arguments to Nunggubuyu, we find that some of the points hold and some do not. The cumulative effect is certainly not as convincing as it is for the Yuulngu languages.

Warndarang (Heath 1980), a near neighbour of Nunggubuyu, shows a rather similar distributional picture to Nunggubuyu. For this language Jeffrey Heath suggests that 'nd and similar sounds are somewhere between ordinary clusters and obvious unit phonemes...' The main distributional evidence for a 'cluster' analysis is that the sequences 'cannot occur syllable-finally, whereas all productive unit phonemes can' (1980:9). The only unambiguous unit phoneme which cannot occur syllable-finally is ḏ, which is marginal in Warndarang. In Nunggubuyu, however, there is a productive inter-dental series for which two members, dh and lh, are extremely common and for which no members can occur syllable-finally. Thus, again, the argument for a 'cluster' analysis is weakened.

To conclude, then, it appears that while the status of homorganic nasal-stop sequences in Nunggubuyu is not entirely free from ambiguity, the balance of the evidence is fairly clearly in favour of their being unit phonemes. In this respect Nunggubuyu differs from the Yuulngu languages and from most of its neighbours, where the balance of the evidence tends to be in the other direction.

FOOTNOTES

1. For example Djinang (Waters 1979:104-5), Yidin^{Y} (Dixon 1977) and Yanyuwa (J. Kirton, private communication), as well as Nunggubuyu. These languages are widely separated genetically.

2. Chomsky and Halle (1968:349f.) state that 'Examples of cyclical application of rules seem to be restricted to prosodic features and segmental modifications closely associated with prosodic features'. The Nunggubuyu data is consistent with this assertion. We require cyclical rule application, but only in order to deal with stress.

3. Syllable-level prosodies appear to be significant in other Australian languages. For example, in Nunggubuyu's near neighbour Anindilyakwa, Leeding (1979:159) reports a prosodic feature of rounding, applying to a whole syllable, affecting both consonants and vowels. Also Wood (1978:80) reports for Gaalpu two prosodic features of syllables, length and a fortis/lenis distinction. Waters (1979:88f.) reports the latter distinction for Djinang as well (using the term 'prominence').

4. I am aware of the hazards involved in using personal names in phonological analysis; however, as far as I can tell, if such names belong to Nunggubuyu-speaking clans they conform to normal Nunggubuyu phonology. This particular name happens to be the only word in my data for which an initial closed S is followed by an SSS stress group meeting conditions B and C.

5. The function of nouns and adjectives in the grammar is so similar that for our purposes they can be taken as equivalent.

6. Derivational prefixes are of form S or SS. The SS prefixes would always form a stress group and therefore not be of any help to us here. Just considering S prefixes, stems of form S or SS would always form a single stress group with the prefix, whatever the boundary; SSS or SSSS stems would likewise always yield SS.SS or SS.SSS, five-syllable adjustment applying in the latter case if the boundary were #. Any S· in the stem would always be preceded by . (unless it is the first syllable) so we would need at least SSSS to precede the S·.

7. D stands for an unspecified stop, deleted on the surface. For this particular example we can disregard it entirely.

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