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DJINANG PHONOLOGY

BRUCE E. WATERS

1. INTRODUCTION

The Djinang language of north-central Arnhem Land is a member of the Murngic group of the Pama-Nyungan family. It is a viable language for about three hundred speakers who live in the region of the Glyde river, south of Milingimbi.

Djinang is the westernmost member of the Yolngu languages[1] of north-east Arnhem Land. These languages have some very interesting phonological features. For example, vowel length appears to be contrastive, and yet vowels rarely are long in unstressed syllables in Yolngu languages. Gupapuyngu for instance, has both long and short vowels in its orthography. When I tested literate and non-literate Djinang speakers for their intuitions about vowel length, I could not get sufficient unambiguous data to allow me to posit vowel length as contrastive. In this paper I will give an explanation for this, and claim that vowel length (in Djinang at least) is non-contrastive.

Also, glottal stop is a feature of Yolngu phonologies that is usually treated as a segment, and yet very clearly has a prosodic function affecting the previous syllable (Wood 1978). There is also, in Djinang at least, a very definite rhythmic patterning within an utterance.

Another interesting feature is a contrast between fortis (voiceless, tense) and lenis (voiced, lax) stops which occurs not only in Yolngu languages (including Djinang) but also in non-Pama-Nyungan languages nearby (Glasgow and Glasgow 1967; McKay 1975). This opposition has sometimes been analysed as a contrast between (fortis) geminated stops and (lenis) non-geminated stops (McKay 1975). However, in this paper I show that this is not possible in Djinang, because gemination is entirely predictable in terms of the distribution of stressed syllables.

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It is interesting that Kirton (personal communication) reports that gemination of voiceless stops also occurs in Yanyuwa, an 'isolate' language in the east of the Northern Territory.

Yolngu languages apparently neutralise the voice/voiceless distinction in stops when they occur word-initially (and in other environments); and yet there are very clear initial contrasts of p/b, tj/dj, and k/g, in Djinang.

There are other phenomena in Djinang that are of interest. For example: why are high vowels characteristically lowered to a 'mid' tongue height position in the initial and/or final syllables of a word? Or again, why does glottal stop very often terminate a Djinang word when spoken in isolation, and yet is only very occasionally present in longer utterances? Also, Djinang speakers very clearly segment their utterances into discrete 'units' by distributing pauses within them.

It is principally these phenomena that occupy my attention in this paper. The paper is written in a transformational generative phonology framework; and distinctive features suitable for Djinang are given early in the paper. Then follow discussions of the data in a less technical manner. Towards the end of the paper I develop rules for handling the phenomena discussed earlier. The paper finishes with an ordered list of the transformational cyclic rules for generating correctly segmented (into rhythmic units) terminal (phonetic) strings.

The data in this paper comes predominantly from speakers in the Murrungun, Marrangu and Manyarrngu clans; and primarily from the Murrungun clan. I express my thanks particularly to Manbarrarra, and Jack Merritji for their willingness and patience in teaching me Djinang.

I would like to thank George Huttar (Senior Linguistics Consultant, Summer Institute of Linguistics, Australian Aborigines Branch) for his editorial assistance and helpful ideas; and thanks to my wife for typing the draft manuscript.

2. LINGUISTIC GROUPINGS: DJINANG AND DJININY

In his paper 'Some Yuulngu Phonological Patterns' (1978) Wood gives linguistic groupings for the Yolngu languages. In this section I will attempt to clarify the picture for the two major linguistic groupings in the Glyde river area: Djinang, and Djininy (the latter is called Djining in Wood's paper). The communalect and clan names given below are written using the standard orthography currently in use for Yolngu languages, except I use /ng/ for /ŋ/.

The Djinang moiety names are djowing and yirritjing which correspond to the more widely known dhuwa and yirritja, respectively. Djinang speakers use **yan** *'language, word'* as a coverterm for a major linguistic grouping, rather than the word meaning *'this'*, which in Djinang is **djining**. Hence they refer to their linguistic grouping as **djinang yan**, or just **djinang**. The other major linguistic grouping in the area is called Djininy. However, to refer to communalects, of which there are many, speakers use the term **djilang** *'tongue'*.

The data given in Wood's paper, cited above, for the Djinang communalects is, in fact, a mixture of clan names (to which the term **bapirrurr** *'group, clan'* applies) and communalect names. This is no fault of Wood, since speakers often give a clan name rather than a communalect name, when asked for the latter, if they cannot quickly remember the communalect name. Accordingly I have obtained both the clan names and the communalect names, and these are given in Tables 1 and 2, along with a rough idea of the clans 'country' (the clan being a land-owning unit), where known. The data in Table 1 is for Djinang, and is meant to replace[2] the information on Djinang communalects found in Wood's paper. It is possible that other Djinang clans exist or existed, but have died out or have been forgotten by my language consultants. I have also obtained some information on Djininy, and this is presented in Table 2. However I have not attempted to gather an exhaustive list for Table 2 so that the data for Djininy must be regarded as complementary to that given by Wood.

TABLE 1: DJINANG CLANS, COMMUNALECTS AND COUNTRIES

Moiety	Clan	Communalect	Country
Dj	Yalingir	Yinbilng	Dhabila creek area
Dj	Marrangu	Munggurrpi	Between Glyde river and Djinbi creek, north of Murwanggi and south of Ramingining
Dj	Manyarrngu	Manyarrngu[3]	West of Glyde river mouth
Dj	Murrungun	Wolkabi	Nganggalala area and east side of Glyde river downstream of Nganggalala
Y	Gilibirrparr	Wulaki	Gatji creek area
Y	Miljingi	Madakarr	Both sides of Glyde river, further downstream than the Murrungun area
Y	Djadiwitjibi	Manyim	Ramingining area
Y	Bälmbi	Wora	Yatjilimiri area north-west of Ramingining
Y	Munyibingi	Bilabila	Escarpment country west of Murwanggi area, Murwanggi area.
Y	Däbi[4]	Djonggi	East of Murwanggi.

TABLE 2: SOME DJININY GROUPINGS

Moiety	Clan	Communalect	Country
Y	Ganalbingu	not known to author	East of Glyde river upstream of Nganggal̲al̲a, and probably other areas
Y	Djinba	Djinba[5]	not known to author
Dj	Mandjalpi	Balawuy	not known to author
Dj	Bal̲awuy	Gurrukurru	Goyder river area

3. THE SEGMENT

3.1. *THE PHONEME SET*

The Djinang phoneme inventory consists of 21 consonant phonemes and three vowel phonemes. Charts 1 and 2 give the basic oppositions, and also the symbols used throughout this paper for these phonemes. The phoneme set is similar to those of other Yolngu languages, except that there is no length contrast in the vowels (although there is semi-predictable phonetic length), and there is no 'interdental' order (perhaps more correctly called a lamino-alveolar order) of consonants.

CHART 1: CONSONANT PHONEMES

	labial	alveolar	apico-postalveolar	lamino-postalveolar	velar
voiceless stops	p	t	t̲	tj	k
voiced stops	b	d	d̲	dj	g
nasals	m	n	n̲	ñ	ŋ
laterals		l	l̲		
glides and rhotics	w	r̃	r̲	y	

CHART 2: VOWEL PHONEMES

	non-back	back
non-low	i	u
low		a

3.2. *THE DISTINCTIVE FEATURE SET*

Only ten distinctive features are needed for establishing contrast between sound classes, and between individual members of the same class. At least a further eleven features are required for handling allophonic variation, various morphophonemic processes, and the specification of significant sound classes. Six of these are given in my paper 'Djinang Verb Morphology' (in this volume).[6] I give a further five features not included in the above-mentioned paper, namely 'tense', 'narrow', 'stress', 'glottal closure' and 'held'. Table 3 lists the contrastive and non-contrastive features used in this paper. The features are as defined in Chomsky and Halle (1968), except for the features 'peripheral', 'narrow', 'held', and 'distributed'. The first three of these will be defined below, and the definition of the last will be modified slightly from that given by Chomsky and Halle. The feature 'continuant', it should be noted, refers to an oral continuant, so that both nasals and stops are specified as non-continuants. Also stress is assumed to be a three-valued feature, taking the values [1 stress] for primary stress, [2 stress] for secondary stress, and [-stress] for unstressed syllables.

TABLE 3: THE DISTINCTIVE FEATURE SET

contrastive		non-contrastive	
syllabic	nasal	continuant	segment
peripheral	lateral	narrow	long
distributed	back	high	tense
anterior	low	round	glottal closure
sonorant	voice	delayed release	held stress
			stress

I have characterised the feature 'peripheral' as follows: peripheral sounds are produced with a primary obstruction that is located at an extremity of the oral cavity; non-peripheral sounds are produced without an obstruction at an extremity of the oral cavity.

For a short discussion of why I prefer to use 'peripheral' rather than 'coronal', see section 5 of my paper 'Djinang Verb Morphology' in this volume.

Chomsky and Halle (1968:312) define the feature 'distributed' in the following manner:

> Distributed sounds are produced with a constriction that extends for a considerable distance along the direction of the air flow; nondistributed sounds are produced with a constriction that extends only for a short distance in this direction.

In order to be able to specify values of this feature for vowels, it is necessary to slightly modify the definition given above for 'non-distributed' sounds so that it reads as follows:

> non-distributed sounds are produced without a constriction that extends for a considerable distance along the direction of the air flow. Hence vowels are [-distributed].

Before I give a definition of the feature 'narrow', some comments from Chomsky and Halle may be useful. When discussing their feature 'consonantal' they write:

> When the blade of the tongue is raised close enough to the roof of the mouth to produce ... obstruction, the result is a true consonant or a liquid. Thus an [l]-sound is produced when the tip of the tongue touches the roof of the mouth, thereby blocking the midsagittal region of the vocal tract. In the case of the common lingual [r]-sounds, the raised tongue narrows the passage sufficiently to produce a consonantal obstruction even if it does not make complete contact with the roof of the mouth.
>
> (Chomsky and Halle 1968:302)

Thus we see that there is considerable variation within the dimension of tongue height; from complete blockage at one extreme (e.g. stops, nasals), to a lack of blockage (e.g. vowels) at the other extreme, and various degrees of narrowing of the vocal passages in between (e.g. fricatives, glides, rhotics, retroflexed vowels). I have set up a feature 'narrow' in order to help differentiate the three degrees of tongue height, hopefully in a useful way. Just as three tongue heights for vowels may be distinguished by the two features 'high' and 'low'; the feature 'narrow' separates sounds with a narrowed passage (e.g. glides, rhotics, retroflexed vowels,[7] fricatives) from those which have either a more open passage (e.g. vowels) or an obstructed passage (e.g. stops, laterals, nasals, affricates).

I have defined the feature 'narrow' as follows:

> narrow sounds are those in which the primary constriction involves a narrowing (without total obstruction) of the vocal tract in the midsagittal region. Non-narrow sounds lack a narrowed primary constriction in the midsagittal region.

There are various reasons for positing such a feature, and these are presented in my paper 'A Proposed Distinctive Feature 'Narrow': Evidence from Djinang and Iwaidja' (Waters 1979). One of the reasons is to have a convenient way of handling rhotics. Without the 'narrow' feature, rhotics are (in Djinang phonology) non-syllabic, continuant, non-distributed, non-lateral sounds; while by using the feature 'narrow' they can be specified simply as narrow non-distributed sounds. Another advantage is that 'narrow' separates liquids into rhotics ([+narrow]) and laterals ([-narrow]). This allows rhotics to be easily kept apart from, say, the class of sounds which are non-syllabic, non-narrow, non-distributed sonorants (that is, l, l̲, n and n̲). This latter class is of importance in both Djinang phonology and morphophonemics. For instance, for consonant clusters in non-reduplicated forms, non-distributed stops are the only non-distributed sounds which may occur after a sonorant consonant (other than in a reduplicated stem). However, there are further restrictions that need to be made: namely, that after a rhotic only a voiceless non-distributed (homorganic) stop may occur, but after the non-rhotic sonorants (that is, after l, l̲, n and n̲) only a voiced non-distributed (homorganic) stop may occur. Hence, rhotics function both partly like nasals and laterals, and partly unlike nasals and laterals. I shall not now go into the morphophonemic evidence for the usefulness of the 'narrow' feature. The interested reader is directed to my 1979 paper.

Under certain phonologically-defined conditions, voiceless stops are unreleased. As far as I can see, Chomsky and Halle's framework (1968) does not give a feature for such behaviour. Hence I have posited a feature 'held' in order to handle unreleased stops. It is defined as follows:

> held sounds are produced by not releasing the primary oral stricture. If another segment immediately follows, the stricture is held while the articulators are adjusted in readiness for the production of the following sound.

Chomsky and Halle state (1968:318) "There are basically two ways in which a closure in the vocal tract may be released, either instantaneously as in the plosives or with a delay as in the affricates". In Djinang however, sounds which are [-delayed release] are of two types: those which have instantaneous release, and those in which the primary stricture is maintained until a following non-vowel (or word break) is articulated. Hence further specification is required. For example: the segment /p/ would be [-del rel, -held] preceding a vowel, but [-del rel, +held] preceding another consonant (or word-finally).

At this point, a few comments about the feature 'anterior' would be appropriate. In his paper 'Some Yuulngu Phonological Patterns', Wood (1978) states "... featrues such as [consonantal] and [anterior], although commonly in use by phonologists, were not found useful". Wood uses the feature 'high' to separate 'anterior', for example, [t] from [t̲], [n] from [n̲], and so forth. Contrary to Wood's claim, I have found the feature 'anterior' to be very useful in Djinang phonology. In Djinang, both 'true' retroflexed sounds (t̲, d̲, n̲, l̲, r̲) and alveolar sounds (t, d, n, l, r̃) are both apical, and as far as the posture of the tongue is concerned, both are retroflexed. For many months I had been assuming that the alveolars must be produced like English alveolars (that is, with the tongue blade), and hence I had continual difficulty in discerning which sounds were 'true' retroflexives, rather than merely alveolars. However, I am now convinced that the only difference between alveolars and 'true' retroflexives is that the latter are produced further back in the mouth. That is, the alveolars are [+anterior] and the 'true' retroflexives are [-anterior], while both orders are apical and thus are distinguished from the non-apicals by the feature 'distributed'.

Wood's use of the feature 'high' as a substitute for 'anterior' obscures the distinction between the alveolars and the (true) retroflexives. In fact, since the 'high' feature is defined (Chomsky and Halle 1968:304) in terms of a raising of the tongue body above the neutral position, it is not clear why Wood characterises [t, n, l and r̃] as [-high], but the retroflexives [t̲, d̲, n̲, l̲ and r̲] as [+high]. It could be argued that both orders are [-high], or even that the alveolars and [+high] while the retroflexives are [-high], since the retroflexion and greater 'backness' of the (true) retroflexives may actually produce a slightly lowered tongue body, in comparison to the alveolars. Presumably Wood's use of the feature 'high' is phonologically based, rather than phonetically based. However, he has not, as far as I can see, made it clear why he has used the feature 'high' rather than the feature 'anterior'. I have experienced no problems in using the latter consistently and usefully in Djinang, up to the present time.

In the paper 'Djinang Verb Morphology' (pp.141-178 in this volume) I assumed that the basic contrast in the point of articulation of consonants was between peripheral versus non-peripheral consonants. Wood (1978) makes the same distinction. However, it is now clear that the primary distinction is between distributed sounds versus non-distributed sounds. This paper will make this clear as we proceed. In fact, I strongly suspect that by assuming the velars [k, ŋ] to be [-distributed], Wood was forced to regard the 'distributed' feature as phonologically unimportant in some contexts, since whenever [p] and [k] functioned alike, or [p], [k] and [tj], both classes had members which differed with respect to the value assigned to the feature 'distributed'. That is, [p] and [tj] were [+distributed], while [k] was [-distributed]. Thus Wood has no one feature that can group [p], [k] and [tj] as a natural class. However, I have already shown in the paper 'Djinang Verb Morphology' that this grouping is a very important one in Djinang,[8] and this paper will reinforce that conclusion. Hence by assigning [k] the value [-distributed], rather than a positive value for this feature, I suspect that Wood has thereby not perceived the fundamental importance of the 'distributed' versus 'non-distributed' dichotomy to Yolngu phonological systems. For example, Wood gives a lenition rule which applies

> between the stops and semivowel within the Laminal set, and within the Peripheral set. This rule operates in Gaalpu to eliminate the lenis series (of stops) from the surface in these two sets (but not from the Apical set), by replacing them with a corresponding semivowel.
>
> (Wood 1978)

That is, following Wood's notation of using upper case symbols for the underlying lenis stops, the changes which occur are that DH[9] and DJ become [y], while B and G become [w], both changes occurring between continuants. Thus, although the 'Peripheral set' and the 'Laminal set' undergo the same process under the same conditions, the Apical set does not. This is strong evidence that the former two 'sets' of sounds are really the one class of sounds; and this would have been capturable if he had assigned the feature value [+distributed] to velars. Thus Wood says

> The essential feature changes involved can be satted in terms of ...
>
> $$[\text{-son}] \rightarrow \begin{bmatrix}\text{+vocalic}\\ \text{-syllabic}\end{bmatrix} \;/\; [\text{+cont}] \;\_\_\_\_\; [\text{+cont}].$$

This rule clearly fails to limit its application to non-Apical obstruents, thereby generating some feature matrices for which there are no Gaalpu sounds. However, if the velars are taken as [+distributed], then the rule may be stated as:

$$\text{(a)} \quad [\text{-son}] \rightarrow [\text{+narrow}] \;/\; [\text{+cont}] \begin{bmatrix}\_\_\_\_\\ \text{+dist}\end{bmatrix} [\text{+cont}]$$

It should be pointed out that the rule (a) is not essentially different if the feature 'narrow' is not used. In this case, we need to specify the environment as non-nasal as well as distributed, so that the rule will not generate distributed nasals, rather than glides. Thus we have

$$\text{(b)} \quad [\text{-son}] \rightarrow [\text{+son}] \;/\; [\text{+cont}] \begin{bmatrix}\_\_\_\_\\ \text{+dist}\\ \text{-nas}\end{bmatrix} [\text{+cont}]$$

Both rule (a) and (b) capture the fact that it is distributed obstruents and no others that are affected. Hence there is strong evidence from Gaalpu, as well as from Djinang, that the basic consonant contrast with respect to 'point of articulation' is between distributed versus non-distributed sounds.

Thus, Djinang consonants can be charted as in Chart 3 below. Other Yolngu languages, since they have a lamino-alveolar order of consonants, would have entries occurring in the empty column (that is, sounds which are distributed, non-peripheral and anterior).

CHART 3: CONSONANT OPPOSITIONS

		+dist				-dist	
		periph		-periph		-periph	
		+ant	-ant	+ant	-ant	+ant	-ant
-son	-vce	p	k		tj	t	t̲
	+vce	b	g		dj	d	d̲
+son	+nas	m	ŋ		ñ	n	n̲
	+lat					l	l̲
	+narr	w			y	r̃	r̲

In Table 3 I gave eleven non-contrastive features. These are used for handling natural classes and morphophonemic processes, and also for handling some (but not all) of the phonetic detail at the phonetic level. The features given will not be able to handle schwa, [ə]. A fully adequate feature system for the phonetic level of Djinang derivations would thus necessarily be more complex than the one given herein.

Chart 4 gives a fully specified feature matrix for all Djinang phonemes, using the features listed in Table 3 (with the exception of stress, and held).

CHART 4: FULLY SPECIFIED FEATURE MATRICES

	p	tj	k	b	dj	g	m	ñ	ŋ	w	y	t	t̲	d	d̲	n	n̲	l	l̲	r	r̲	i	u	a
seg	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
syll	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	+
dist	+	+	+	+	+	+	+	+	+	+	+	−	−	−	−	−	−	−	−	−	−	−	−	−
periph	+	−	+	+	−	+	+	−	+	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−
ant	+	−	−	+	−	−	+	−	−	+	−	+	−	+	−	+	−	+	−	+	−	−	−	−
son	−	−	−	−	−	−	+	+	+	+	+	−	−	−	−	+	+	+	+	+	+	+	+	+
cont	−	−	−	−	−	−	−	−	−	+	+	−	−	−	−	−	−	+	+	+	+	+	+	+
narr	−	−	−	−	−	−	−	−	−	+	+	−	−	−	−	−	−	−	−	+	+	−	−	−
nas	−	−	−	−	−	−	+	+	+	−	−	−	−	−	−	+	+	−	−	−	−	−	−	−
lat	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	−	−	−	−	−
back	−	−	+	−	−	+	−	−	+	+	−	−	−	−	−	−	−	−	−	−	−	−	+	+
low	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+
high	−	+	+	−	+	+	−	+	+	+	+	−	−	−	−	−	−	−	−	−	−	+	+	−
voice	−	−	−	+	+	+	+	+	+	+	+	−	−	+	+	+	+	+	+	+	+	+	+	+
round	−	−	−	−	−	−	−	−	−	+	−	−	−	−	−	−	−	−	−	−	−	−	+	−
long	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−
tense	+	+	+	−	−	−	−	−	−	−	−	+	+	−	−	−	−	−	−	−	−	−	−	−
del rel	−	+	−	−	+	−	−	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−
glot	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−

Although glottal stop is not part of the Djinang phoneme system, the feature 'glottal closure' is included to handle it. Glottal stop takes positive values for the features 'glottal closure' and 'tense', and all other features are assumed to be negative, including the feature 'segment'. That is, glottal stop functions as a formative boundary. This will become clear as we examine its distribution later in the paper. I suspect that it functions in the same way in other Yolngu languages also (see Wood 1978).

Finally, on input to the transformational cycle of the phonological component, all segments are specified [-stress]. The cyclic rules will then place stress at the correct places within the string.

3.3. *PHONEME CONTRASTS*

The phoneme contrasts in Yolngu languages are sufficiently well known from the writings of others (for example, Wood 1978; Lowe 1960) that I need spend time here only on the interesting features of Djinang contrasts.

3.3.1. Voiceless Versus Voiced Stops

In Yolngu languages, it is common to find more than one stop series. One series is voiceless, unaspirated and phonetically tense, and this muscular tension very often produces a discernable temporal lengthening of the tongue (or lip) gesture used to produce the stop. The other series is voiced, lax and non-tense. Some languages preserve the opposition on the surface in all points of articulation (for example, Djinang, Gupapuyngu), while at least one other neutralises it in some points of articulation (for example: Gaalpu, which retains the distinction only for true retroflexed stops). In addition, there is also neutralisation due to distributional factors. For example, Wood (1978) states that neutralisation occurs word initially, and after non-continuants (that is, after stops and nasals). This is true for Gaalpu, and it seems to be true for Gupapuyngu, as the spelling of Gupapuyngu words is consistent with this rule.

Djinang, however differs from other Yolngu languages in this respect. The voiced/voiceless (or lax/tense) distinction is not neutralised at any of the points of articulation, nor is it neutralised word initially[10] or following another consonant. In fact, there is a constraint which pertains to sequences of a consonant followed by a stop. This will be dealt with later on. However, if the constraint is ever violated, it is the preceding consonant which is altered rather than the following stop undergoing a voicing neutralisation.

Another interesting phenomenon is the relative infrequency of occurrence of non-distributed (that is, apical) stops, in comparison with distributed (that is, labial, velar and lamino-postalveolar) stops. Voiceless apical stops (/t/ and /t̲/) to not occur word initially, and occur far less frequently than non-apical stops word-medially or word-finally. Voiced apical stops (/d/ and /d̲/) occur word-initially or word-medially, but never word-finally, as there is a constraint that syllable-final stops must be voiceless. In initial position, /d/[11] occurs more frequently than /d̲/. Word medially, both occur following a homorganic nasal, or lateral, but intervocalically /d̲/ is much more frequent than /d/. In addition, no function word, pronoun, or suffix, begins with an apical stop. These restrictions are less rigid for apical sonorants. I shall say a lot more about the infrequency of apical stops at a later stage, in particular under the heading of stress groups. I do not know why apical stops are so infrequent, though I suspect that the solution is to be sought in the area of diachronic language change.

Before giving Djinang language examples of contrast, the symbols to be used hereafter will now be explained. Lowered high vowels will be represented as [e] and [o], and schwa by [ə]. Unreleased stops will be marked with the symbol /⌴/ above the stop (for example p̆, t̆j, etc.), and long sonorant consonants will be marked by a macron /¯/ above the consonant (for example m̄, l̄, r̃̄, etc.). Vowel length will be marked by /:/. Primary stress is marked by /'/ preceding the syllable, and secondary stress by /´/ above the syllabic (vowel). Glottal stop is marked by /ʔ/, and stress-groups (to be defined later) have their word-medial boundaries delimited by /./. Morpheme breaks are symbolised by /+/ and stem or word breaks by /#/. Boundary symbols will be included only when significant for exemplification purposes, except for stress-group boundary symbols, which will always be included.

initial contrasts

/pir̃idjigi/	['pir̃i.djíge]	*'cause to wind'*
/bir̃mir̃idji/	['bir̃.mír̃i.djeʔ]	*'sing'*
/par̃tji kir̲i/	['par̃.tji# kír̲iʔ]	*'will be spearing'*
/bar̃itji/	['bar̃i.tjiʔ]	*'long yam'*
/puldjiban/	['pol.dji.bə́n]	*'full up now'*
/bulidji/	['boli.djiʔ]	*'fly (insect)'* (ERG inflection)
/tjalatjaŋ/	['tjala.tjə́ŋ]	*'south'*
/djalir̲igi/	['djalir̲i.geʔ]	*'bury'*
/tjiltjigi/	['tjil.tji.geʔ]	*'leak'* (verb, class 1)
/djildjigi/	['djil.djíge]	*'cuddle'*

/tjutjtjutj/	['tjut̚j.'tjut̚j]	*'keep on doing it'*
/djut/	['djut̚]	*'stop'* (at a specified place)
/kar̲gur̃iyili/	['kar̲.gúr̃i.yileʔ]	*'outside'*
/gar̲pan/	['gar̲.pán]	*'type of tree'*
/kar̲gi/	['kar̲.geʔ]	*'pick out of the fire'*
/kat̲a/	['kat̚.taʔ]	*'large star'*
/gaka/	['gak̚.ka:]	*'bush snail shell'*
/kur̃itjir̃i/	['kur̃i.tjír̃e]	*'iron wood tree'*
/gur̃umba/	['gur̃um.baʔ]	*'magpie geese'*
/kaliki/	['kali.keʔ]	*'have, possess, look after'*
/galigi/	['galiy.geʔ]	*'turn on to its side'*
/kukir̃idji/	['kuk̚.kír̃i.djiʔ]	*'walk about looking for food'*
/gubidji/	['gobi.dji]	*'leave (it), ebb'*

medial contrasts

/kupidjir̃i/	['kop̚.pi.djír̃e]	*'be still at a task'*
/gubidji/	['gobi.dji]	*'leave (it), ebb'*
/katjigi/	['kat̚j.tjigeʔ]	*'catch, hold on to'*
/gadjir̲i/	['gadjir̲eʔ]	*'yesterday'*
/ŋiltjaŋ/	['ŋil.tjáŋ]	*'of us*(dl.incl.)*'*
/ŋildjaŋ/	['ŋil.djáŋ]	*'of you*(pl.)*'*
/butjir̲i/	['bot̚j.tjir̲eʔ]	*'ear'*
/budjir̃i/	['bodjir̃eʔ]	*'stomach, belly'*
/yakir̃i/	['yak̚.kir̃eʔ]	*'asleep'*
/yagir̃i/	['yagir̃eʔ]	*'name'*
/ŋir̲ki/	['ŋir̲.keʔ]	*'bone'*
/ŋir̲gi/	['ŋir̲.geʔ]	*'pandanus fruit'*
/but̲al/	['bot̲̚.t̲ál]	*'good, well, satisfactory'*
/bud̲i/	['bod̲eʔ]	*'blood'*
/mat̲it̲/	['mat̲̚.t̲ít̲̚]	*'hard'*
/mad̲im/	['mad̲im]	*'offal (of fish)'*
/matamigi/	['mat̚.ta.míge]	*'tie up, coil'*
/dadawmigi/	['dadaw.migeʔ]	*'prevent, cause to stop'*

final contrasts

Voiceless stops, but never voiced stops, may occur word-finally. All stops in this position are unreleased.

/mar̃kap/	['mar̃.káp̚]	*'pleasing, wonderful'*
/wukutj/	['wok̚.kút̚j]	*'goanna'*
/djar̲ak/	['djar̲ak̚]	*'fish spear'*
/labut/	['labut̚]	*'type of wallaby'*
/djar̃kut̲/	['djar̃.kút̲̚]	*'sharp edge'*

3.3.2. Nasal Contrasts

There are five contrastive points of articulation for nasals, corresponding to the five contrastive points of articulation of the stops. Nasals, as for stops, are divided into an apical group, and a non-apical group. Both apical nasals (/n/ and /ṉ/) are articulated with a degree of retroflexion, and contrast only with respect to point of articulation; alveolar versus postalveolar (or domal), respectively.

initial contrasts

/mamiṟi/	['mamiṟe]	*'brain, mind'*
/ñami/	['ñameʔ]	*'saw, seeing'*
/ŋambir̃i/	['ŋam.bir̃e]	*'mother'*
/nami/	['nameʔ]	*'on top of'*
/ñuŋuŋ/	['ñuŋuŋ]	*'your*(sg.)*'*
/ŋunŋiṟi/	['ŋun.ŋiṟeʔ]	*'from that time, from that place'*
/nundjir̃i/	['nun.djir̃e]	*'run, fly, drive'*
/ṉuŋgaṯmigi/	['ṉuŋ.gáṯ̆.míge]	*'forbid, punish'*

medial contrasts

/ñami/	['ñameʔ]	*'saw, seeing'*
/ñañi/	['ñañeʔ]	*'was seeing'*
/ñaŋi/	['ñaŋeʔ]	*'see, will see'*
/ñani/	['ñaneʔ]	*'he, she, it'*
/wiṉi/	['wiṉeʔ]	*'returned'*

final contrasts

/lim/	['lim]	diminutive of *'we*(pl.incl.)*'*
/liñ/	['liñ]	diminutive of *'we*(du.excl.)*'*
/ñaliŋ/	['ñaliŋ]	*'where?'*
/kar̃alkaŋ/	['kar̃al.káŋ]	*'sing the announcement of a death'*
/wir̃iban/	['wer̃i.bán]	*'nothing now'*
/wur̃upaṉ/	['wur̃u.páṉ]	*'emu'*

3.3.3. Liquid Contrasts

Liquids contrast word initially, medially and finally.

initial contrasts

/luŋgu/	['luŋ.goʔ]	*'harpoon'*
/ḻur̃kal/	['ḻur̃.kál]	*'waist'*
/r̃ir̃kiyañ/	['r̃ir̃.kiyǽñ]	*'rock'*
/ṟikidji/	['ṟik̆.ki.djiʔ]	*'rain'* (verb)

medial contrasts

/galbi/	['gal.bi]	*'many'*
/gul̲tji/	['gul̲.tjeʔ]	*'fat'*
/gur̃uŋ/	['gur̃uŋ]	*'cousin'*
/bar̲im/	['bar̲im] ∿ ['parim]	*'overflowing, spreading'*

final contrasts

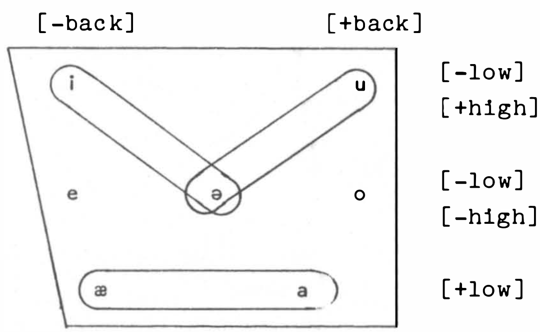
/djawal/	['djawal]	*'area of land, possessed by a landowner'*
/djagal̲/	['djagal̲]	*'saliva'*
/djiwar̃/	['djiwar̃] ∿ [dji'war̃]	*'far above'*
/wir̲ar̲/	['wir̲ar̲]	*'with who?'*

3.4. *PHONETIC VARIATIONS OF SEGMENTS, AND THEIR RELATION TO STRESS*

3.4.1. Vowel Variations

Chart 4 shows the range of variations of the canonical vowels /i/, /u/ and /a/.

CHART 4: PHONETIC VARIATIONS OF VOWELS



variants of /a/

A non-back allophone [æ], of the phoneme /a/ occurs optionally in some environments.

$$[+\text{low}] \rightarrow [-\text{back}] \;/\; \begin{bmatrix} +\text{dist} \\ -\text{periph} \end{bmatrix} \_\_\_\_ \;[-\text{back}] \quad (\text{optional})$$

Examples:

/giyañ/	['giyæñ]	*'ant'*
/r̲ir̃kiyañ/	['r̲ir̃.kiyǽñ]	*'rock'*
/ñaliki/	['ñæli.kiʔ] ∿ ['ñali.kiʔ]	*'which way?'*
/yar̲imban/	['yær̲im.bán] ∿ ['yar̲im.bán]	*'but'*
/tjalir̃djigi/	['tjælir̃.djigeʔ] ∿ ['tjalir̃.djigeʔ]	*'break (waves)'*

There is some evidence that /a/ may be neutralised to [i] when it occurs in an unstressed syllable between lamino-postalveolar consonants. Only two examples of this have been observed:

/dja-tjalir̃djigi/	[dji?'tjælir̃.djíge]	*'breaking (waves)'* (durative aspect)
/r̲ir̃kiyañ/	['r̲ir̃.kíyiñ]	*'rock'*

Examples of this nature are rare because, as will be shown later in this paper, the phoneme /a/ is phonetically more prominent than the vowels /i/ and /u/, and hence resists neutralisation. The second example above was articulated quite quickly, and the stress on the second stress group shifted to the normal stress-group-initial position, allowing /a/ to be realised as [i]. Compare the more slowly spoken ['r̃ir̃.kiyǽñ] *'rock'*.

non-low non-high allophones: [e] and [o]

Phonological non-low vowels, /i/ and /u/, which are phonetically [+high], are lowered to [-high] allophones [e] and [o] in one of two circumstances.

Firstly, when /i/ occurs word finally, particularly in words of form #CVCi#, the final vowel frequently is lowered to [e] and followed by glottal stop. Word final /u/ is similarly frequently lowered to [o]. Examples:

/wali/	['wale?]	*'vegetable food'*
/gad̲it̲i/	['gad̲it̲e?]	*'sister'*
/bar̃awu/	['bar̃a.wo?]	*'canoe'*

However, both the lowering of the final vowel, and closure with the glottal stop, depend on other factors. For words spoken in isolation, glottal stop is a closure mechanism, and frequently occurs word finally provided the word ends in a vowel. It occurs nearly always with words of form #CVCV# spoken in isolation, whether or not the final vowel is lowered. For longer words ending in a vowel, it does not occur so frequently. We shall deal further with glottal stop later in this paper, when we deal with stress groups. In discourse, glottal stop does not occur as a word-closure mechanism.

Lowering of word-final high vowels is not as frequent in words of three syllables or more, in comparison with words of two syllables. Moreover, when lowering occurs (for words spoken in isolation) it is usually accompanied by glottal stop closure. Thus we have

/bar̃awu/	['bar̃a.wo?]	*'canoe'*
/djilaku/	['djila.ko?]	*'type of kangaroo'*
/djuŋulu/	['djuŋulo?]	*'mad, crazy'*

and also

/gir̃ala/	['gir̃ala]	*'ibis'*
/djimur̃u/	['djimur̃u]	*'east'*
/minini/	['minine]	*'wife'*

This suggests a connection between vowel height lowering and glottal stop. I will return to this point shortly.

Secondly, lowering of high vowels occurs frequently in primary-stressed syllables. Hence, since Djinang words normally have primary stress on the first syllable, [e] and [o] often occur in the first syllable of a word, but not word medially in unstressed syllables. Examples:

/wur̃uŋi/	['wor̃u.ŋeʔ]	*'old person'*
/biligi/	['beli.geʔ]	*'long ago'*

Very often, [-high] allophones of /i/ and /u/ occurring in a primary stressed syllable have phonetic length. Even the low vowel /a/ can have length in the same circumstances, thus we have:

/midji/	['me:dji]	*'grandmother (mother's mother)'*
/wuwi/	['wo:weʔ]	*'older brother'*
/gir̃i/	['ge:r̃eʔ]	*'finished, next'*
/ŋadji/	['ŋa:dji]	*'cry'*

But it is also possible, though less frequent, to have lengthened high vowels without lowering, thus:

/djidji/	['dji:djeʔ]	*'sore, a split'*
/ŋili/	['ŋi:leʔ]	*'we*(du.incl.)*'*

However, in fast speech, phonetic length on the vowel is reduced. Thus /gir̃i/ *'finished, next'*, when spoken quickly, is usually heard as ['gir̃]. (Elision of final vowels will be treated in a later section.) Even the addition of a suffix can affect vowel length; thus when /-aw/ *'all'* is suffixed to /midji/ ['me:dji] *'grandmother'*, we get /midjaw/ ['medjaw] *'all the grandmothers'*. Similarly /wuwaw/ ['wowaw] *'all the brothers'*.

Elision of the initial consonant of a pronoun also reduces vowel length; thus /ŋili/ ['ŋi:leʔ] has the allomorph /il/ ['il] *'we*(du.incl.)*'*.

A further phenomenon, to be dealt with in detail later on, is that a voiceless stop, occurring after an open syllable which has stress, geminates to provide an unreleased voiceless stop closure for the preceding (open) stressed syllable. Thus /yut̲i/ ['yot̲̚.t̲eʔ] *'egg'*.

So, in primary-stressed syllables we observe that there is optional lengthening of vowels, and these are affected by suffixation, elision and speed of articulation. We also observe a mechanism for providing phonetic closure of a stressed open syllable by gemination of a following voiceless consonant. Gemination, however, is not affected by changes in the speed of articulation.

The facts presented above suggest that lowering of high vowels, vowel length, voiceless stop gemination, glottal stop, and stress, are related phenomena. When listening to the tape-recorded data on which this paper is based (approximately a thousand words), I often had difficulty in deciding if a word-final open syllable followed by a glottal stop was stressed. Certainly, [e] and [o] occurring word finally and followed by glottal stop are auditorily prominent. The psychological impression to my ear was that of a 'stressed' syllable, and yet, with few exceptions, there was only a glottal stop closure to the open syllable occurring word-finally, rather than stress. (Stress will be defined later, in section 5.1., in terms of higher pitch, increased duration, and fortis articulation.)

To support the contention that glottal stop is related to stress, consider the following verb data:

> Verb stems of class I in the non-past tense end in the sequence /djigi/ and this sequence forms a stress-group. Secondary stress normally occurs on the first syllable, but both syllables may appear to be equally stressed (or unstressed). When secondary stress occurs on the first syllable, glottal stop rarely follows the word, thus we get:
>
> /bad̲ir̲idjigi/ ['bad̲ir̲i.djɩ́ge] *'make, kill, hit'*
>
> However, when there is no apparent difference in the stress (if any) on both syllables the word has a glottal closure. Thus we get:
>
> /bur̃djiŋdjigi/ ['bur̃.djɩ́ŋ.djigeʔ] *'become dry'*

Thus it appears that phonetic prominence may be achieved by stress (when the initial syllable of a stress group has prominence), or by a glottal stop closure of a word-final open syllable (when the word-final syllable has prominence). The closure of word-final prominent open syllables by a glottal stop is clearly parallel to the closure of stressed open syllables by gemination of a following voiceless stop.

The notion of prominence will be dealt with in section 5.2., so I will not spend time on it here. It is sufficient to observe that stress is one of several manifestations of prominence, so that while every stressed syllable is a prominent syllable, not every prominent syllable is stressed. This accounts for the uncertainty I had in deciding whether word-final open syllables with glottal stop closure were stressed or not. In general, they are made prominent by glottal stop closure rather than by a secondary stress.

That length of vowels and prominence are related can be further demonstrated from the following data:

> When spoken in isolation, the normal articulation of a word of form #CVCV# would be [ˈCVCVʔ], hence /wali/ [ˈwaleʔ] *'vegetable food'*. If the second consonant is a voiceless stop, such a word would be articulated as [ˈCVC͡CVʔ], hence /wat̲i/ [ˈwat̲̚.t̲iʔ] *'wind'*. For a word of form #CV#, the normal articulation is an unknown quantity, as there are only a few such words.
>
> The following words departed from these norms. The interesting point is the conditions under which the departure from the norm was obtained. The language consultant was given a word from the dictionary and asked to repeat it two or more times in succession. Usually this produced very similar results on each repeat of the word. However, in the following three words, both the alternatives cited below were given without prompting:
>
> /gaka/ *'bush snail'*
> first two repeats: [ˈgak̚.kaʔ], third repeat: [ˈgak̚.ka:]
>
> /na/ *'bark canoe'*
> first repeat: [ˈna:], second repeat: [ˈnaʔ]
>
> /nu/ *'foot, root'*
> first two repeats: [ˈno:], third repeat: [ˈnoʔ]

Hence it is clear that vowel length, word-final glottal stop, lowering of high vowels, gemination of voiceless stops, and stress, are all interrelated phenomena in Djinang. Thus it behooves us to seek an underlying mechanism to account for these diverse surface phenomena. This we shall do when we discuss stress-groups, and prominence.

schwa and neutralisation

To complete the discussion of vowel variants, we must examine the neutralisation of the 'back' distinction in high vowels. Schwa may occur when the initial syllable of a word is unstressed, provided the syllable is open and begins with a stop. Thus we get:

/bid̲ak/	[bíˈd̲ak̚] ~ [bəˈd̲ak̚]	*'wait a moment'*
/d̲ubuk/	[d̲úˈbuk̚] ~ [d̲əˈbuk̚]	*'carry, pick up'*
/djubuy/	[djəˈbuy] ~ [djiˈbuy] ~ [djúˈbuy]	*'go away!'*

Notice in the last example that in the word-initial unstressed syllable beginning with /dj/, the lamino-postalveolar is able to condition the occurrence of [i].

Durative aspect, which involves reduplication of the first consonant and vowel of a verb stem, can also produce words with non-initial stress. Under these conditions, [ə] is often the realisation of the stem vowel in the reduplicated (and unstressed) initial syllable of the word. Glottal stop characteristically occurs as a syllable closure, to indicate the reduplicative nature of the initial syllable. Hence we get:

/ŋu-ŋuři/	[ŋəʔ.'ŋořeʔ]	*'is sleeping'*
/pu-pumi/	[pəʔ.'pomeʔ]	*'is hitting'*
/dji-tjaři/	[djəʔ.'tjařeʔ] ∿ [djiʔ.'tjařeʔ]	*'is standing'*

In the last example, the underlying stem is #/djiři/#. The change of /i/ to /a/ in the stem is dealt with in my article 'Djinang Verb Morphology' in this volume.

The vowel /a/ is highly resistant to being neutralised to schwa. The only examples that I have of /a/ being neutralised (though not to schwa) are:

/r̲iřkiyan/	['r̲iř.kíyiñ]	*'rock'*
/dja-tjaliřdjigi/	[djiʔ.'tjæliř.djíge]	*'breaking (waves)'* (durative aspect)

3.4.2. Consonant Variations

unreleased voiceless stops

Voiceless stops are unreleased when they occur word finally or preceding another consonant. (Thus, when a voiceless stop geminates to a stop sequence the first member of the sequence must be unreleased.)

$$[\text{-son}] \rightarrow \begin{bmatrix}\text{-voice}\\ \text{+held}\end{bmatrix} \Big/ \;\_\_\_ \begin{Bmatrix}\#\\ [\text{-syll}]\end{Bmatrix}$$

Examples:

/miyilk/	['miyilk̚]	*'woman, wife'*
/kayitj/	['kayit̚j]	*'shovel-nosed spear'*
/kupidjiři/	['kop̚.pi.djíře]	*'tardy, still doing (something)'*
/mukmigi/	['mok̚.migeʔ]	*'cause to cease talking'*

rhotics

The alveolar rhotic, /ř/, is often heard as a flap [ř], particularly in fast speech. Thus we have

/mur̃ibin̲/ ['mur̆i.bín̲] ∿ ['mur̃i.bín̲] *'heavy'*
/mur̃ur̃t/ ['mur̆ur̃t] ∿ ['mur̃ur̃t] *'plains grass'*

The alveolar rhotic is also often heard as a (retroflexed) postalveolar [r̲], and when following a vowel the degree of retroflexion can be reduced to the point that no rhotic is discernable - giving the effect of a long vowel. Thus we can get:

/war̃war̃/ ['war̃.'war̃] ∿ ['war̲.'war̲] ∿ ['war.wa:] *'follow after (an an event), be complete'*

The retroflexion of the postalveolar rhotic, /r̲/, is also frequently reduced in fast speech when a vowel precedes. Thus:

/war̲ŋar̃iñ ['war̲.ŋar̃íñ] ∿ ['wa:ŋar̃íñ] *'so-and-so'*

4. THE SYLLABLE

4.1. *SYLLABLE TYPES*

There are three underlying syllable patterns: **CV**, **CVC**, and **CVCC**. These are mutually contrastive in word-initial, medial, and final positions. Many of the examples below are given without brackets, because syllable breaks do not always have phonological reality in Djinang.

initial position
'bo,d̲eʔ[12] *'blood'*
'win̲,d̲eʔ *'antbed, anthill'*
'wur̲p̆,meʔ *'one'*

medial position
'ŋa,mi,ge *'paint'* (verb)
'ba,man,peʔ *'from long ago, old one'*
ŋi,'djir̃k̆,ŋeʔ *'near'*

final position
'bo,meʔ *'hitting, hit'*
'dji,niŋ *'this'*
'bo,malŋ *'shade'*

Variants of the **CV** and the **CVC** syllables occur, in which the initial consonant is absent; thus a limited number of words may commence with a syllable of form **V**, or **VC**. Such syllable variants only occur word initially. Commonly, such forms are the result of morphophonemic changes. For example, many pronouns can have one (or more) of their initial segments deleted. The effect is reminiscent of English speakers preferring *'don't'* to *'do not'*.

Examples:

ˈíl	*'we*(du.incl.)'
'e,r̃e	*'I'*

A few words with initial vowels are not synchronically traceable to underlying forms with an initial consonant that is deleted by subsequent morphophonemic processes. These are:

/iŋki/	['iŋ.kiʔ]	*'no, not'* (emphatic)
/indji/	['in.djiʔ]	reciprocal/reflexive marker

and a few forms which appear to be fossilised dative pronominal forms:

/inga/	['in.gaʔ]	*'for him, for her'*
/ingir/	['in.gír̃]	*'I, for him/her'* (portmanteau)
/inma/	['in.maʔ]	*'for you*(sg.)'
/inmir̃/	['in.mir̃]	*'I, for you*(sg.)' (portmanteau)

Other person and number combinations in this (fossilised) paradigm seem to be entirely lacking.

The above facts argue for omitting **V** and **VC** as underlying syllable types in Djinang, largely due to their non-productivity in word building.

One other syllable type is the syllabic nasal or lateral. Many forms take suffixes of the form '[+nasal]i'. These suffixes often (in fact, it is the norm) undergo elision of the word-final /i/ provided a vowel precedes the suffix - and particularly if a morpheme or word follows the suffix. However, in the case of the [+peripheral] nasals, this vowel elision may also occur when the suffix is preceded by a voiceless stop. The result is a syllabic nasal. Thus we have:

[ŋi'djir̃k̆.ŋ̩]	*'near'*
['wur̠p̆.m̩]	*'one'*
['bip̆.m̩.bán]	*'is hitting now'*

Syllabic nasals may occur only word medially or finally.

One example of a syllabic lateral occurs, namely when the word /l̠itmim/ *'turning around'* is inflected for durative aspect. We get:

[l̠ʔ.'l̠et̆.mím] *'keeps turning around'*

I would expect that syllabic nasals could potentially occur word-initially by the above mechanism, for durative aspect on certain verbs. However, I have not observed any examples up to the present time.

On the basis that syllabic nasals and laterals always derive from underlying /**N**i/ syllables, I am not positing these as a separate syllable type.

4.2. *SYLLABLE PROSODIES*

In Wood's paper (1978) he states:

> ... syllables also possess prosodic features which further divide them into:
>
> (a) fortis and lenis syllables.
>
> (b) long and short syllables.
>
> ... Fortis syllables are distinguishable by the presence of a phonetic glottal stop in syllable final position. This glottal does not have segmental status, but functions as a prosody of the fortis syllable.

I am indebted to Wood for this crucial observation. It is one of two insights that enabled clarification of the interrelationship of stress, glottal stop, voiceless stop gemination, vowel length, and non-initial primary-stressed syllables in Djinang.[13]

Although it is possible to speak of stress as a prosody, it is not necessary to do so in an analysis based on distinctive features. It is sufficient to assume that the syllable nucleus is specified for a value of the feature 'stress'. It is then possible to construct rules for phonetic processes that are triggered by the value assigned to this feature, whether [1 stress], [2 stress], or [-stress]. This is the approach used in generative phonology, and I have retained it throughout this paper.

4.3. *DISTRIBUTION OF PHONEMES IN THE SYLLABLE*

All consonants may appear as the onset of each of the three syllable types. Furthermore, in **CVC** syllables, the final consonant may be any consonant except a voiced stop. I do not know of any situation where it could be argued that a voiced stop occurs in the coda of either a **CVC** or a **CVCC** syllable, and which subsequently is neutralised with respect to voicing and hence becoming voiceless. The only **apparent** counter-examples occur in class I or class III verbs, inflected for today-past-irrealis (or today-past-continuous). Thus we get:

['ŋoyiñt̚j.ñír̲] *'sneezed'* (irrealis)

from an underlying ŋu,yiñ,dji,ñir̲ (see pp.141-178 in this volume). Thus the unreleased voiceless stop [t̚j] derives from an underlying following syllable. Hence, the absence of voiced stops in the coda of a syllable is taken to be a syllable-structure constraint, rather than a neutralisation phenomenon. This can be expressed as (Hyman 1975):

(1) if: V C ,

$$\begin{array}{lll} \text{then:} & \begin{array}{c} \downarrow \\ \begin{bmatrix} \alpha \text{son} \\ \alpha \text{voice} \end{bmatrix} \end{array} & \text{where } \alpha = + \text{ or } - \end{array}$$

In the case of CVCC syllables, the constraint is

(2) if: V C C ,

$$\begin{array}{llll} \text{then:} & \begin{array}{c} \downarrow \\ [+\text{son}] \end{array} & \begin{array}{c} \downarrow \\ \begin{bmatrix} \beta \text{son} \\ -\text{cont} \\ \beta \text{voice} \end{bmatrix} \end{array} & \text{where } \beta = + \text{ or } - \end{array}$$

Thus, this constraint allows the peniltimate consonant to be a nasal, lateral, rhotic or glide; and the final consonant to be a nasal or a voiceless stop. This constraint is a little too general, as Chart 5 below indicates. As mentioned above, for class I or III verbs inflected for today-past-irrealis or today-past-continuous, the juxtaposition of a stem final sonorant consonant and the /dj/ onset of the following syllable results in morphophonemic processes whereby the /dj/ becomes a [t͡j] in the coda of the preceding syllable (see pp.141-178 in this volume). Thus all sonorants may precede a syllable final [t͡j], by this mechanism, in a CVCC syllable. If consonant clusters (in the coda of a CVCC syllable) produced by this mechanism were ignored, then only apical ([-distributed]) sonorants and the glide /y/ would be found to precede /tj/ in the lexicon. The constraint given above also does not show that for a syllable final nasal (in a CVCC syllable), the nasal must be [+distributed]. It does not show that a non-distributed sonorant is preferred as the penultimate consonant, and a distributed peripheral voiceless obstruent is preferred as the final consonant. Neither does it show that a 'narrow' consonant (glides and rhotics) may only be followed by a voiceless obstruent[14] (never by a nasal). This offers some justification for defining 'narrow' so as to group glides and rhotics as a natural class.

CHART 5: CLUSTERS IN THE CODA OF CVCC SYLLABLES

penultimate consonant	final consonant	occurrence
all sonorant consonants	tj	produced phonetically by morphophonemic rules modifying a following syllable
l	m	
n	m	
l	k,ŋ	in the lexicon
l̲	k	
r̃	p,t,k	
r̲	p,k	
w	k	

4.4. *CONSONANT CLUSTERS ACROSS SYLLABLE BOUNDARIES*

Chart 6 gives consonant clusters in Djinang that have been observed to date. The restrictions on consonant clusters within a syllable are thus seen to be more restrictive than across syllable boundaries.

The first consonant of a cluster is on the left of the chart, and the second is at the top of the chart. The symbol 'R' implies that the only examples of such a cluster involve clusters which occur across a reduplication boundary within a reduplicated stem.

Voiced stops may not precede another consonant, and thus rows for voiced stops have been eliminated from the chart. Also, non-distributed sonorants (that is, n, n̲, l, l̲, r̃ and r̲) may not follow another consonant, and so the non-distributed sonorant columns have also been eliminated from the chart.

CHART 6: CONSONANT CLUSTERS

C_1 \ C_2			+dist											-dist			
			-son						+son					-son			
			p	tj	k	b	dj	g	m	ñ	ŋ	w	y	t	t̲	d	d̲
+dist	-son	p					+		+	+	+						
		tj	+			+	+		+	+							
		k				R	+		+		+	R					R
	+son	m	+		+	+	+			+	+						
		ñ		+	+		+	+	+								
		ŋ			+	+	+	+	+	+	+					R	
		w			+	+	+		+		+						
		y	+	+	+	+	+	+	+			+				R	
-dist	-son	t	+	R	R		+		+								
		t̲	+	R	R		+	R	+								+
	+son	n	+	+	+	+	+	+	+		+					+	
		n̲			+	+	+	+	+	+	+						+
		l	+	+	+	+	+	+	+	+	+	+	+			+	
		l̲	+	+	+	+	+		+		+	+					
		r̃	+	+	+	+	+	+	+		+	+	+	+			
		r̲	+	+	+	+	+	+	+		+	+	R		+		

The constraint that voiced stops do not occur in the coda of syllables was given in section 4.3. From Chart 6 we observe that a further constraint is required. No non-distributed sonorant consonant may follow another consonant. Furthermore, if the second consonant of a cluster is a non-distributed obstruent (that is, t, t̲, d or d̲), the preceding consonant must be homorganic. We can go further than this, to say that voiceless non-distributed obstruents may be preceded only by homorganic rhotics (or by a geminate), while voiced non-distributed obstruents may be preceded only by homorganic non-rhotics (that is, by homorganic, non-distributed, non-narrow consonants). Hence we get the sequences r̃t, tt, r̲t̲, t̲t̲, ld, l̲d̲, nd, n̲d̲, and t̲d̲; but not, say, *r̃d, *r̲d̲, *lt, *l̲t̲, *nt, *n̲t̲. Reduplications, which give rise to kd̲, ŋd and yd in Chart 6, are not counter-examples. The reduplication boundary is a word boundary (#) and phonotactic constraints do not apply across such boundaries.[15]

We can express the above conditions by the following constraints:

(3)

$$\text{if:} \quad \begin{bmatrix}\text{-syll}\\ \text{+son}\end{bmatrix} \qquad \begin{bmatrix}\text{-syll}\\ \text{-dist}\end{bmatrix}$$

$$\downarrow \qquad\qquad\qquad \downarrow$$

$$\text{then:} \quad \begin{bmatrix}\text{-dist}\\ \alpha\text{narr}\\ \beta\text{ant}\end{bmatrix} \qquad \begin{bmatrix}\text{-son}\\ \beta\text{ant}\\ -\alpha\text{voice}\end{bmatrix} \qquad \alpha,\beta = + \text{ or } -$$

(4)

$$\text{if:} \quad \begin{bmatrix}\text{-syll}\\ \text{-son}\end{bmatrix} \qquad \begin{bmatrix}\text{-syll}\\ \text{-dist}\end{bmatrix}$$

$$\downarrow \qquad\qquad\qquad \downarrow$$

$$\text{then:} \quad \begin{bmatrix}\text{-dist}\\ \alpha\text{ant}\\ \text{-voice}\end{bmatrix} \qquad \begin{bmatrix}\text{-son}\\ \alpha\text{ant}\end{bmatrix} \qquad \alpha = + \text{ or } -$$

Constraint (3) states that rhotics may precede voiceless homorganic stops; or that laterals or apical nasals may precede homorganic voiced stops. Constraint (4) handles the cases where two apical stops occur in a cluster. For such a sequence, the stops must be homorganic, and the first one must be voiceless. The only example to date of a voiced apical stop following a voiceless homorganic stop is in the word

/d̲it̲d̲iy/ ['d̲it̲.d̲íy] *'milkwood tree'*

Other than this example, constraint (4) applies (redundantly) only to geminated voiceless apical stops, since gemination is the only means whereby such apical stop sequences may occur in Djinang. Constraint (3) applies equally to consonant clusters in the coda of **CVCC** syllables, and to clusters occurring across syllable boundaries. In fact, the only example I have of the /r̃t/ sequence, occurs in the coda of a **CVCC** syllable:

['mur̃ur̃t̚] *'plains grass'*

However, constraint (3) cannot replace constraint (2) of section 4.3., since constraint (3) does not allow a distributed sonorant to occur as the penultimate consonant in a **CVCC** syllable. Also, constraint (2) permits nasals to occur syllable finally in **CVCC** syllables, while constraint (3) does not. Both constraints (2) and (3) are needed.

The distribution of t and t̲, compared with d and d̲, in consonant clusters is evidence for a phonologically important distinction between rhotics and other apical sonorant consonants. This offers strong support for the feature 'narrow', or for a feature like it that would separate rhotics from other sonorant consonants.

It is clear from the chart that there apparently is no restriction on distributed consonants occurring after another consonant.

5. STRESS GROUPS

5.1. *STRESS GROUPS AND RHYTHM*

Djinang speakers characteristically divide their speech into audible rhythmic units. These are most easily heard when a word comprised of several closed syllables is articulated. Perceptually, one hears such a word as a series of pulses, each pulse correlating with a closed syllable. Thus we have:

/milkuḻtjiṉdjigi/ [ˈme:l.kúḻ.tjíṉ.djíge] *'covet'*
/melbur̠kbur̠kdjim/ [ˈmel.búr̠k̚.búr̠k̚.djím] *'aim (gun or spear)'*
(The morpheme [ˈme:l] ∿ [ˈmel] means *'eye'*, and is very productive in forming compounds.)
/ñaŋŋaŋŋir̠/ [ˈñan.ŋáŋ.ŋír̠] *'from his'*

In fact, whenever a consonant cluster occurs within a word, there is a break in the rhythm during articulation of the word - the final consonant of the cluster being the onset of both a following syllable and a following rhythmic unit.[16] However, when open syllables are brought into the picture, we find that rhythmic breaks sometimes occur after open syllables, and sometimes do not. We also find that when a rhythmic break occurs after an open syllable, the following consonant is always a distributed consonant.

Hence, several open syllables can form a rhythmic unit; and a rhythmic unit ending with an open syllable is never followed by a non-distributed consonant. This latter fact is reminiscent of the consonant cluster constraint (3) of section 4.4., where non-distributed sonorant consonants could not follow another consonant, while non-distributed obstruent consonants could follow another consonant only under quite stringent conditions (and consider note 16 also). Thus, a rhythmic boundary has (phonologically speaking) a consonant-like character,[17] since the same or similar constraints apply to a rhythm boundary - consonant sequence, as to a consonant - consonant sequence.

We therefore define stress groups (which are the structural correlates of rhythm) as follows: "A stress group is composed of from one to three[18] syllables, with only one stress which normally falls on the first syllable.[19] No consonant clusters may occur stress group medially."

It is necessary to specify here the phonetic characteristics of stress in Djinang. Three parameters are involved; namely, pitch, duration, and fortis articulation (Hyman 1975:207).

Primary stress has the highest pitch, and since primary stress normally occurs word initially, most Djinang words commence with higher pitch which falls slowly as the word is articulated, with a sharp drop in pitch on the last syllable. If the primary stress occurs on the second syllable, pitch rises to a maximum in the nucleus of the primary-stressed syllable, and falls thereafter. The effect of a word-medial secondary stress, in relation to pitch, is normally to delay the lowering of pitch. This is most obvious in words comprised of reduplicated stems, where each of the reduplications normally is equally high in pitch, of equal duration, and equally fortis.

Duration, which may take several forms (such as vowel lengthening, or voiceless stop gemination, etc.) is particularly evident in primary stressed syllables, but rarely so in a secondary stressed syllable.

Fortis articulation, produced by increased muscular tension (in terms of features [+tense]) in the articulation of the syllable, appears to be the most universal of the three parameters. It is evident not only in primary stressed syllables, but also in secondary stressed syllables.

Examples:

/balŋgidjidji/	['balŋ.giyɪ.dyɛʔ]	*'be afternoon'*
/bambuli/	['bam.bótɛʔ]	*'bark'*
/badadji/	['bada.dyiʔ]	*'banyam tree'*
/pagapagadjuw/	['paga'paga.dyó]	*'stagger, be raving'*
/bilay/	[bi'lay]	*'long way'*

As a consequence of the definition of a stress group, we can construct a total of six different stress groups:

(a) three 'open' stress groups
'CV, 'CVCV, 'CVCVCV, and

(b) three 'closed' stress groups
'CVC(C), 'CVCVC(C), 'CVCVCVC(C)

Examples:

open type

/bu/	['bo:]	*'faeces'*
/kani/	['kaneʔ]	*'digging stick, ingested'*
/wagiři/	['wagiře]	*'crow'*

closed type

/yul/	['yo:l]	*'man, husband'*
/galŋ/	['galŋ]	*'body'*
/midjiř/	['midjiř]	*'dust'*
/bumalŋ/	['bumalŋ]	*'shade'*
/djumiliŋ/	['djumiliŋ]	*'blunt'*

(I do not have an example of the subtype 'CVCVCVCC.)

These six different stress groups can be in any order within words.[20] Normally, words are comprised of from one to three stress groups, but words of four stress groups do occur. The majority of words are comprised of one or two stress groups; words comprised of three stress groups are less frequent, and about ten times less frequent than the latter are words comprised of four stress groups. A sample of some combinations of different stress group types is given below.

['bo:.gíṉiŋ]	*'having faeces, not fat, dried up'*
[dí'r̃a.djige?]	*'eat'*
[ŋí'djir̃k̆.ŋ.bán]	*'near now'*
['bali.dje?]	*'die'*
['bar̃i.tji?]	*'long yam'*
['gadji.gír̃e]	*'on the track'*
['gala.káŋi]	*'uncover, sweep area clean'* (from #galaka+ŋi#)
['gadji.gár̃]	*'track, road'*
['miṟi.kál]	*'clothes'*
['gadji.gír̃iŋ]	*'at a point on the track'*
['goḏi.tjimár̃]	*'small star'*
['bagili.ge?]	*'fetch'*
['miṟi.gi.píle]	*'bad ones'*
['yowiṟi.djíŋ]	*'new ones'*
['gur̃uṯa.gíṉiŋ]	*'having kin relationship'*
['yaṟi.tjíge?]	*'tear'*
['ŋur̃u.bír̃i.dji?]	*'perspire'*
['paga.'paga.djíge]	*'stagger, be raving'*
['bur̃u.'bur̃u.páṟim]	*'one after another (events)'*
['ñini.ñíṟ.be?]	*'for sitting, a chair'*
['djini.pán.gumá?]	*'right here now'*
['djar̃a.píṉ.djíl.ge?]	*'spread out a bed on the ground'*
['wiṉi.djíŋil.ge?]	*'take back'*
['bem.be?]	*'noise'*
['bam.bóle]	*'bark'*
['galm.ŋúr̃e]	*'repeatedly falling'*
['muyt͡j.píni.ge?]	*'build'*
['giṉ.ḏilále]	*'bring to land (from water)'*
['djan.ŋáŋ]	*'their*(pl.)*'*
['ḏuṟk̆.'ḏuṟk̆]	*'heart'*
['wen.góŋiṟ]	*'wrong handed, left handed'*
['djal.tji.be?]	*'from the ground'*
['maṉ.ḏi.gíṉiŋ]	*'crocodile'*
['djam.bi.djíge]	*'change'*

['gul̠.wír̃i.djiʔ]	*'palm trees'*
['djuk̚.már̃.geʔ]	*'spit'*
['but̚j.ñír̠.djígeʔ]	*'break by pulling, sever'*
['ŋuy.már̠.gín̠iŋ.djíge]	*'hate'*
['dam.píliñ.djúw]	*'make it short!'*
['djimin̠.d̠eʔ]	*'short spear'*
['beneŋ.gileʔ]	*'two'*
['gibil.bál]	*'ashes'*
['malip̚.málir̠]	*'future time, tomorrow'*
['bulaŋ.gít.djín.maʔ]	*'this is good'*
['djal̠.wír̃i.djíge]	*'slip down'*

I have made this a long list deliberately in order to have clearly established norms with respect to which comparison may be made when gemination and other phenomena are taken into account.

5.2. PROMINENCE

In section 3.4.1., it was shown that certain phonetic properties (for example: stress, length, voiceless stop gemination, and glottal stop) appeared to be interrelated. In this section, and in the sections to follow, we shall explore the nature of these and other interrelationships. The unifying factor behind the phenomena that have been mentioned in preceding sections is the notion of 'prominence' (Hyman 1975: 203).

A syllable may be made prominent by a variety of means. The most common of such means is stress, but other phenomena may also signal a prominent syllable. Hyman (1975) lists the following as potential markers of prominence: stress, vowel length, greater force of articulation, gemination of consonants, greater intensity (that is, greater acoustic energy), pitch, and other parameters. For Djinang, to the above list we could also add lengthening of sonorant consonants, glottal stop closure of an open syllable, and lowering of tongue height for high vowels.

In section 3.4.1. it was shown that glottal stop is used in two ways in Djinang. One way it is used is to mark a reduplicated CV manifesting durative aspect on some verbs. Thus the verb ['ŋor̃eʔ] *'sleeps'* becomes [ŋəʔ.'ŋor̃eʔ] *'is sleeping'* when inflected for durative aspect. Here glottal stop manifests prominence on the reduplicated part. Primary stress remains on the non-reduplicated part of the stem.

Reduplication normally does not involve glottal stop, and not all reduplication signals durative aspect. Normally, when a verb is reduplicated, the whole of the stem is reduplicated and the stress pattern of the stem is repeated in the reduplicated part. Some reduplicated forms are given below:

/wuywuytjigi/	['wuy.'wuy.tjigeʔ]	*'shake to and fro'*
/wud̲uwud̲udjigi/	['wud̲u.'wud̲u.djíge]	*'wrap, fold'*
/pagapagadjigi/	['paga.'paga.djíge]	*'stagger'*
/djir̃idjir̃idjigi/	['djir̃i.'djir̃i.djíge]	*'go down'*
/buwalbuwaldjigi/	[bú'wal.bú'wal.djigeʔ]	*'bubbling water'*

The other use of glottal stop is to make a word-final open syllable more prominent, by using glottal stop as a phonetic closure. Both uses of glottal stop thus come within the scope of prominence.

How glottal stop is used in other Yolngu languages needs more study. Wood (1978) has done an excellent study of the use of glottal stop in Gaalpu. In fact, in Gaalpu it appears that glottal stop (or something related to it - for example, fortis syllables) is contrastive. Wood also shows that prominent syllables (he calls them fortis syllables) are normally marked by a glottal stop 'separater' after the prominent syllable, but after a prominent open syllable followed by a voiceless stop there is gemination of the stop instead. The latter effect is, of course, identical to that occurring in Djinang. Also, in Gaalpu, after a prominent closed syllable followed by a voiceless stop, there is again no glottal stop, and Wood argues that the fortisness ([+tense]) of the voiceless stop makes the presence of glottal stop unnecessary in this context. Wood's proposals are extremely appealing, and the Djinang evidence certainly lends strong support to much of his analysis.

Also in section 3.4.1., I showed that wherever primary stress or glottal stop were used to manifest a prominent syllable, it was also possible for vowels to be either lengthened, or high vowels lowered, or both, in the same prominent syllable. The implication is, of course, that both high vowel lowering and vowel length are purely phonetic manifestations of prominence. This accounts for why long vowels and lowered high vowels are found only in primary-stressed syllables, or word-finally. It also accounts for the fact that Djinang speakers do not have unambiguous intuitions about whether a given vowel in a primary-stressed syllable is long or not.

In a primary-stressed syllable, there is always greater duration (often manifested as a lengthening of the vowel) than in a non-primary-stressed syllable. Lengthened vowels occur most frequently in words of one or two syllables; and in longer words, they are more frequently found in primary-stressed syllables that are open, rather than closed. Lengthened vowels never occur when there is gemination of a following voiceless stop.

It is not hard to see why vowel lowering is a prominence mechanism. By lowering the tongue, the oral cavity becomes a larger resonant cavity - and thus more acoustic energy is imparted to the signal than would be the case if there was no lowering of the tongue. Thus lowering of high vowels and vowel length are ways in which syllables may be made more prominent.

It is also clear why prominence on the final syllable of a word is not manifested by stress. Pitch normally falls from its highest value in the primary-stressed syllable of a word to its lowest value at the end of the word. But since pitch is an important characteristic of stress, it is not possible to have rapidly falling pitch in the final syllable of a word and have stress in the same syllable also. Thus, in an utterance, word breaks are signalled by primary stress on the initial syllable of a word and/or by lowering (and occasionally by length) of word-final vowels. Utterances will be considered in section 6., and data exemplifying these comments is to be found there.

5.3. *GEMINATION OF VOICELESS STOPS*

Gemination of voiceless stops is apparently a widespread phenomenon in Aboriginal languages (McKay 1975, 1977; Glasgow and Glasgow 1967). It occurs in non-Pama Nyungan languages, for example: Rembarrnga (McKay 1975); Burarra (Glasgow and Glasgow 1967), and others. It occurs also in some (if not all) of the Yolngu languages (which are all Pama Nyungan), for example: Gupapuyngu, Gaalpu, Djambarrpuyngu (Wood 1978), and Djinang. It also occurs in the isolate, Yanyuwa (Kirton, personal communication), spoken in the Gulf country near Borooloola.

Some researchers (McKay 1975, 1977; Glasgow and Glasgow 1967; Schebeck 1976) have gone further and postulated that the voiceless stop versus voiced stop be interpreted **phonologically** as a contrast between un-geminated (lenis, voiced) stops and geminated (fortis, voiceless) stops. Glasgow and Glasgow no longer maintain this interpretation in their practical orthography; but as far as I know, the other researchers still adhere to this interpretation.[21]

In what follows, I hope to demonstrate that gemination of voiceless stops, in Djinang, is an entirely phonetic phenomenon. That is, it is non-contrastive, being totally predictable from environmental factors. Not all voiceless stops occurring intervocalically are geminated in Djinang, although all are fortis in articulation. If it should prove impossible to predict when such a stop is geminated, and when not, then we would have grounds for assuming the phenomenon to be phonological. However, it is possible to predict gemination, and we will do so on the basis of the position of voiceless stops in relation to open stressed syllables.

The following set of examples demonstrates that all voiceless stops may be geminated.

/bapi/	['bap̆.peʔ]	*'shoulder'*
/matamigi/	['mat̆.ta.míge]	*'tie up, coil'*
/kat̲a/	['kat̲̆.t̲aʔ]	*'bright star'*
/batji/	['bat̆j.tjiʔ]	*'dilly-bag'*
/buka/	['buk̆.kaʔ]	*'be under prohibitions (at time of circumcision)'*

The next set of examples show that it is possible to have ungeminated voiceless stops, or both geminated and ungeminated ones together.

/gad̲it̲i/	['gad̲it̲eʔ]	*'sister'*
/bapipi/	['bap̆.pipeʔ]	*'aunt'*
/djilaku/	['djila.koʔ]	*'type of kangaroo'*
/kukur̃um/	[kuʔ.'kur̃um]	*'hanging'* (durative)
/kukir̃idji/	['kuk̆.kír̃i.djiʔ]	*'walk about'*
/bar̃itji/	['bar̃i.tjíʔ]	*'long yam'*
/katjin kir̲im/	['kat̆j.tjín.kír̲im]	*'gathering, collecting'*
/djinipilaŋ/	['djini.piláŋ]	*'somewhere here'*
/bunapi/	['buna.peʔ]	*'trepang'*

In these last two sets of examples, voiceless stops are observed to geminate only when they follow a primary-stressed open syllable. The phonetic effect of this is to cause the stress group in which the gemination occurs to become two stress groups, the first of which is a phonetically 'closed' type - where the closure is obtained by the regressive gemination of the voiceless stop onset of the following syllable.

Hence, while /bapili/ ['bapile] is, at one stage of its derivation, only one stress group; the application of the gemination rule converts it to ['bap̆pile], and the geminate cluster thus produced re-triggers the rule[22] for placement of stress group boundaries, to produce ['bap̆.pile]. Geminate clusters produced by this mechanism are very numerous - approximately one word in every ten, based on my dictionary data. A selection of examples follows:

/miki/	['mek̆.keʔ]	*'red ochre'*
/wat̲ir̲i/	['wat̲̆.t̲ir̲eʔ]	*'by the wind'*
/bipin̲i/	['bip̆.pineʔ]	*'hit, made'*
/d̲utjigi/	['d̲ut̆j.tji.geʔ]	*'squeeze'*
/kupidjir̃i/	['kop̆.pi.djír̃e]	*'be still doing it'*

/wukiřidjigi/	['wok̆.kíři.djíge?]	*'write'*
/mapal/	['map̆.pál]	*'hair, leaf'*
/gikaŋgi/	['gik̆.káŋ.ge?]	*'bird name'*
/dupin̲miři/	['dop̆.pín̲.míře]	*'in the bone pole'*
/wupupdjuw/	['wop̆.púp̆.djúw]	*'blow!'*

Regressive gemination, whereby there is provided a phonetic coda for an underlying open (and stressed) syllable, is statistically the most commonly occurring type of gemination. It is possible, however, to obtain progressive gemination of voiceless stops, although it is not very common because conditions favourable to it occur only infrequently. When a stem ending in a voiceless stop undergoes suffixation (or compounding) with a form beginning with a vowel, the voiceless stop in the stem progressively geminates in order to provide an onset for the following syllable. I have only three examples on tape: two examples involve the suffix -Vpmi *'just X, not something else'* (where X is the semantics of the form to which the suffix is attached); the third is a compound word involving the morpheme /indji/ 'reciprical/reflexive marker'. Thus we have the following:

/bid̲akipm/	[bə'd̲ak̆.kíp̆.m]	*'just wait a while'*
/ŋuřuwakapm/	['ŋuřu.wák̆.káp̆.m]	*'just the first'*
/butjindjiřkuŋ/	['bot̆j.tjín.djíř.kúŋ]	*'listen'* (lit. *'give one's own ear'*)

The stem in the first example is /bid̲ak/, that of the second is /ŋuřuwak/, and that of the third example is /butj/ (which is a diminutive form of /butjir̲i/ *'ear'*). When the stem ends in a vowel, suffixation of -Vpmi does not produce gemination: hence, for the stem /miliki/ *'have a look'*, we get ['meli.kúp̆.m] *'just have a look'*, rather than ['melik̆.kúp̆.m].

The rules for progressive and regressive gemination are as follows:

progressive gemination rule

$$\emptyset \rightarrow \begin{bmatrix} \alpha\text{dist} \\ \beta\text{periph} \\ \gamma\text{ant} \\ -\text{son} \\ -\text{voice} \end{bmatrix} \Big/ \begin{bmatrix} \alpha\text{dist} \\ \beta\text{periph} \\ \gamma\text{ant} \\ -\text{son} \\ -\text{voice} \end{bmatrix} + \underline{\quad\quad} [+\text{syll}]$$

where α,β,γ = + or −

regressive gemination rule

$$\emptyset \rightarrow \begin{bmatrix} \alpha\text{dist} \\ \beta\text{periph} \\ \gamma\text{ant} \\ -\text{son} \\ -\text{voice} \end{bmatrix} \Big/ \begin{bmatrix} +\text{syll} \\ \delta\text{stress} \end{bmatrix} \underline{\quad\quad}(.) \begin{bmatrix} \alpha\text{dist} \\ \beta\text{periph} \\ \gamma\text{ant} \\ -\text{son} \\ -\text{voice} \end{bmatrix} [+\text{syll}]$$

where α,β,γ = + or −, and δ = 1 or 2

Regressive gemination of a voiceless stop following an open secondary-stressed syllable is very rare, because conditions favourable for it occur only infrequently.

/djawalkitjidji/ ['djawal.kit̚j.tji.dje?] *'it is my country'*

In the above example a voiceless stop follows a secondary-stressed open syllable. It is not hard to see why voiceless stops occur so infrequently in such a position. Firstly, a long word is required in order to obtain a non-word-initial stress group of at least two syllables - so that a voiceless stop may potentially fill the second onset slot in that stress group. Secondly, the majority of two-syllable stress groups take the form [+dist] V [+son] V ([+son]),[23] and particularly so if the stress group is not word-initial. Also, when the second consonant is an obstruent, it is usually voiced. Besides that, a word-medial distributed voiceless stop is highly likely to be made the onset of a stress group - and thus would not be a candidate for gemination. Add to this the fact that non-distributed voiceless stops (t and t̠) are extremely rare, and they never occur in suffixes or derivational morphemes, then we can see why voiceless stops occur so infrequently after a secondary-stressed open syllable.

Progressive gemination is clearly motivated by pattern pressure in syllable structure. On the other hand, regressive gemination is a prominence mechanism. By providing an unreleased (and tense) voiceless stop closure to an underlying stressed open syllable, the speaker is able to impart considerable fortisness to the syllable. The unreleased stop closure functions to 'check' the fortis articulation, preventing it carrying on to succeeding syllables.

The amount of fortisness which may occur on the primary-stressed syllable is variable.[24] If sufficiently strong, it can cause lengthening of a following sonorant consonant, provided the stressed syllable is open. This is obviously not different in kind to the gemination of voiceless stops under the same conditions, both effects being manifestations of prominence. Lengthening of sonorant consonants will be treated in detail in the next section.

5.4. *LENGTHENING OF SONORANT CONSONANTS*

In section 5.2. I indicated that the lowering of high vowels allowed for more acoustic energy in the signal. Since [a] is more open than any of [i, u, e and o], it follows that /a/ vowels are perceived as more prominent than /i/ or /u/ vowels.

When a word of form 'C a [+son] a (C) is articulated, not only is the first syllable prominent due to the presence of /a/ and stress, but also the second syllable has greater prominence than would be the case if the vowel in the second syllable were not /a/. Under these conditions, the medial sonorant consonant is lengthened, so that it functions both as the coda of the prominent (primary-stressed) initial syllable, and also as the onset of the second syllable. I have one example on tape where this lengthening is clearly present at a normal speed of articulation, but the second vowel in the word is /u/, not /a/. The only clear examples on tape are words of two syllables, as given below. I believe this effect is present in longer words, but spectrographic measurements are needed to confirm it. It is not necessary for the initial syllable to have an /a/ vowel (one example is given below), but examples in this case are harder to find. The following is a list of the clear cases that I have on tape:

/wana/	['wan̄aʔ]	*'big'*
/bala/	['bal̄aʔ]	*'European style house'*
/yañaŋ/	['yañ̄aŋ]	*'talk'*
/baman/	['bam̄an]	*'a long time'*
/gar̃ay/	['gar̃̿ay]	*'wonderful'*
/djayal/	['djaȳal]	*'slowly, less'*
/djayar̃/	['djaȳar̃]	*'pandanus palm'*
/mañaŋ/	['mañ̿aŋ]	*'try, find, test'*
/ralal/	['ral̄al]	*'hole'*
/war̃ay/	['war̃̿ay]	*'perhaps'*
/muŋan/	['moŋ̄an]	*'lower back, down river'*
/bar̲uw/	['bar̲̄uw]	*'spread it!'*

It is quite clear that this is another realisation of prominence, of the same genre as gemination of voiceless stops in the same environment.

5.5. *NON-INITIAL STRESS*

Approximately two percent of Djinang words have primary stress on the second syllable of the word, rather than on the initial syllable. This typically occurs when the initial syllable has a non-low vowel, while the second syllable has the low vowel /a/, provided that the two syllables occur in the same stress group. Thus an /a/ vowel can have sufficient acoustic energy to move the primary stress off the initial syllable and onto a following syllable containing the vowel /a/.

/diřadjigi/	[dí'řa.djigeʔ]	*'eat'*
/djud̠apdjigi/	[djú'd̠ap̚.djíge]	*'sneak up, stalk'*
/giřabili/	[gí'řa.bileʔ]	*'ashes'*
/wir̠aŋ/	[wí'r̠aŋ] ∿ ['wir̠aŋ]	*'whose?'*
/wir̠ar̠/	[wí'r̠ar̠] ∿ ['wir̠ar̠]	*'with who?'*
/bid̠ak/	[bí'd̠ak̚] ∿ [bə'd̠ak̚]	*'wait'*
/biřal/	[bí'řal]	*'true'*
/bir̠al/	[bí'r̠al]	*'withered, lifeless'*
/milařdjin/	[mí'lař.djín]	*'downwards'*

This effect is not limited to primary-stressed syllables; as /a/ can cause shift of a secondary-stress also.

/bilapilaŋ/	['bila.piláŋ]	*'it is like that'*
/gud̠itjimař/	['god̠i.tjimář]	*'small star'*
/gin̠d̠ilali/	['gin̠.d̠iláleʔ]	*'bring to the land (from the water)'*
/ŋinbilaŋ/	['ŋin.biláŋ]	*'ours'*

Not all words which satisfy the requirements for stress shifting actually undergo the stress shift rule. Included in the list of words which do not undergo stress shifting are all those in which the second consonant of the word is a voiceless stop. These undergo gemination of the voiceless stop instead, thus permitting prominence to remain on the initial syllable of the word.

/pikaŋ/	['pik̚.káŋ]	*'fishing line'*
/djukal̠/	['djuk̚.kál̠]	*'type of fish'*
/butjalak/	['but̚j.tjalák̚]	*'yellow ochre'*
/gikaŋgi/	['gik̚.káŋ.geʔ]	*'type of bird'*
/ŋiřaŋ/	['ŋiřaŋ]	*'my'*
/djiwař/	['djiwař]	*'high above'*
/gunař/	['gonař]	*'type of fruit'*

The following rule handles the stress shifting[25] discussed thus far:

$$\underset{1}{\begin{bmatrix}+\text{syll}\\-\text{low}\\\alpha\text{stress}\end{bmatrix}}\quad\underset{2}{[+\text{voice}]}\quad\underset{3}{[+\text{low}]}\rightarrow\begin{bmatrix}1\\-\text{stress}\end{bmatrix}\;2\;\begin{bmatrix}3\\\alpha\text{stress}\end{bmatrix}$$

where α = 1 or 2

There is a residue of six words with non-initial primary stress that this rule does not handle. They are the following:

/ŋidjiřkŋ/	[ŋí'djiřk.ŋ]	*'close to'*
/djiřiy/	[djí'řiy]	*'stand up!'*
/gunbuluřu/	['gun.bulóřo]	*'type of thick-stemmed grass'*

/mad̲ayin/	[má'd̲ayin]	*'sacred, powerful'*
/djubuy/	[djú'buy] ∿ [djə'buy]	*'go away!'*
/indjir̃/	[ín.'djir̃] ∿ ['in.djír̃]	*'not I'*

When the stress shift rule has operated so as to shift the primary stress on to the second syllable of a word, it is then possible for a voiceless stop following the second syllable to be geminated - provided the second syllable is an open syllable. Therefore the stress shift rule must be ordered before the gemination rule.[26] Thus we get:

/gur̲aki/	[gú'r̲ak̚.keʔ]	*'nape of neck'*
/yir̃atjigi/	[yi'r̃atj̚.tji.geʔ]	*'scratch'*
/wir̲apili/	[wí'r̲ap̚.pileʔ]	*'which ones?'*
/-gir̲api/	[-gí'r̲ap̚.peʔ]	*'from'* (suffix)

6. PAUSE GROUPS

6.1. *UTTERANCES*

In the previous sections we have been dealing with words uttered in isolation. Now we shall consider short utterances. When we consider utterances, not only do we observe all the phenomena discussed in preceding sections (glottal stop, vowel length, stress groups, gemination of voiceless stops, high vowel lowering, stress shifting, etc.), but we observe that utterances are broken up into discrete units by pauses. These discrete units I call 'pause groups', and they will be symbolised by '∖', representing 'pause'. I will treat 'pause' as a further type of boundary symbol, so that it will be specified as [-segment] (Chomsky and Halle 1968:364). However, at this level, the distinction between phonological categories and grammatical constituents appears to break down. Pause groups appear to be grammatically significant, so that the placement of pause group boundaries, (∖), cannot be achieved by purely phonological criteria. This problem is one which must be addressed in a description of Djinang grammar, so I will leave it for a later time. I do feel, however, that the notion of a 'pause group' will be more significant grammatically than a notion such as 'clause'; hence I expect Djinang sentences to be composed of a series (one or more) of pause groups. Whether or not pause groups are phrase structure constituents yet remains to be seen.

I will now give a set of seven different short utterances for exemplification purposes. Some will contain pauses, others will not. However, before I give the phonetic representations, I will first present the utterances in phonemic script, with morpheme breaks indicated by a hyphen, and with glosses below the individual morphemes.

1. /ñuni djambaku-gi djalŋ-bin̲i/
you *tobacco*-dative *likes-one who hungers for*

'You are a person who likes tobacco.'

2. /madjir̃i ñimi/
next *what*

'What next?'

3. /nadji bil win̲i-dji bapili/
when *they*(du.) *return*-future *(to)here*

'When will those two come back here?'

4. /ñani Tasha \ gadjir-a \ ŋa-ŋadji/
she *Natashia* *yesterday*-setting marker durative aspect-*crying*

'Natashia was crying yesterday.'

5. /djuŋ-ir̃a \ bilay-ŋir̲i \ ir̃i minali/
wood-my *a long way-from* *I* *carried(it)*

'I carried my wood from a distant place.'

6. /mayur̃k indji malim-dji-g-a \
rain *itself* *finish*-verbaliser-future-setting marker

ŋunu-kin̲iŋ-ban ir̃i gir̲i/
that(time)-having-then *I* *go* (future)

'When the rain finishes, I will go.'

7. /munacha \ ŋuñili ŋir̃a-li \ gur̃bi-le \ ir̃i bir̃u-gi/
sand *(to) that* *my-to* *camp-to* *I* *take*-future

'I will take sand to my camp.'

The above data were taken from a tape comprising (at present) about 130 short utterances. Each utterance is repeated several times. Occasionally, some of these repeats differ in interesting ways, and hence I have included some of the variants in the phonetic representations below. These utterances are not a random sample, and hence do not show that statistically words frequently end in a consonant.

1. ['ñoni.'djam.bák̆.ku.ge.'djalŋ.bin̲eʔ]
2.(a) ['madjir̃e.'ñi:meʔ] ∿
2.(b) ['madjir̃e.'ñi:m̄eʔ]
3. ['ñadji.'bil.'win̲i.dji.'bap̆.pileʔ]
4. ['ñani.'Tasha: \ 'gadjir̲a: \ ŋəʔ.'ŋa:djeʔ]
5.(a) ['djuŋ.gir̃aʔ \ bi'lay.ŋir̲eʔ \ 'er̃e.'minaleʔ] ∿
5.(b) ['djuŋ.gir̃a: \ bi'lay.ŋir̲e: \ 'er̃.'minaleʔ]
6. ['mayur̃k̆.'in.dji.'malim.djíga: \ 'ŋunu.kín̲iŋ.bán.dir̃e.'gir̲e]
7. ['muna.tja: \ 'ŋuñili.'ŋir̃ale: \ 'gor̃.bile: \ 'er̃e.'bir̃u.geʔ]

Utterance 2(b) varies from 2(a) in that there is a lengthened sonorant consonant ([m̄]) in 2(b). Utterance 2(b) was spoken with noticeably increased fortition on the stressed open syllable ['ñi:]. The lengthening of the following sonorant consonant is precisely what we would expect, as explained previously in section 5.4.

In utterance 4, 5(b), 6, and 7, we observe that if a pause group ends with an open syllable, the vowel in that syllable is lengthened. Utterance 5(a) has glottal stop closure, instead of long vowels, before the pause.

The above utterances somewhat clarify the rules for vowel lengthening and glottal stop closure. Thus we can postulate that vowels may be lengthened if they occur as the final segment of a pause group. Also, that a glottal stop usually (but not always, as in utterance 6) provides closure for a sentence (assuming that these utterances are sentences), or may provide closure for a pause group. This is why I claimed (in section 3.4.1.) that glottal stop does not function as a word closure mechanism in discourse.

In section 5.2. it was stated that prominence could 'shift' to the final syllable of a word, but no explanation was given as to why this should be so. However, we are now in a position to explain why this occurs (also, see section 6.2.). Examination of utterances 1 through 7 reveals that normally the final syllable of pause groups is prominent. Thus, in 1, we get ['djalŋ.bin̲eʔ] rather than #['djalŋ.bín̲e]; in 5(b) we get [bi'lay.ŋir̲e:\] rather than #[bi'lay.ŋír̲e:\]; and in 6 we get ['malim.djiga:\] rather than #['malim.djíga\]. We shall say more about this later on.

In utterance 6, we observe that the morpheme /iři/ (which is a diminutive of /ŋaři/ '*I*') is phonologically attached to the preceding word, via a transition consonant [d]. This transition consonant satisfies the constraints on consonant clusters,[27] and is required in order to ensure that the /iři/ morpheme is a separate stress group. This behaviour is reminiscent of the progressive gemination discussed in section 5.3.

The stress group boundaries within words in the above utterances are in the same positions as would be the case if the words were spoken in isolation. We observe that word boundaries, #, have been replaced by the stress group boundary '.'.

I will now give a short text, which will complete the picture. The text was given by a language consultant when I asked him how I would state that I wanted to go to Yachilimiri to learn Djinang.

8. /a	bintji	gir̲i	\	a	bintji	gir̲i
and	*like this*	*go*(future)		*and*	*like this*	*go*(future)

Yatjilimir̲-l̲i	\	a	ŋuli	waŋi-dji	\	djani	ñaliki-dji
Yachilimiri-to		*and*	*there*	*speak*-future		*they*	*how*-future

waŋi-dji	'maḻu ╲	a	ŋiřaŋ	wuwi	mala ╲	a	ŋiřaŋ
speak-future	*daddy*	*and*	*my*	*brother*	plural	*and*	*my*

gaḏiṯi	mala ╲	ñaliki	djin	waŋi-dji ╲	iri-ñ		djin
sister	plural	*how*	*they*	*speak*-future	*me*-accusative		*they*

maṟaŋgi-dji-gi/
teach-verbaliser-future

'This is what I will do, I will go to Yachilimir and speak (Djinang) there. In the manner that they speak: daddy, and my brothers and sisters, how they speak (Djinang) they will teach me.'

8. [a.'ben.tji.'giṟe: ╲ a.'ben.tji.gíṟe.'yaṯj.tjíli.míṟ.ḻeʔ ╲
a.'ŋo:le.'waŋi.djiʔ ╲ 'djan.'ñali.kídji.'waŋi.dji.'ma:ḻu: ╲
a.'ŋiřaŋ.'wo:we.'ma:la: ╲ a.'ŋiřaŋ.'gaḏiṯe.'ma:laʔ ╲
'ñali.ki.'djin.'waŋi.djiʔ ╲ 'eřiñ.'djin.'maṟaŋ.gi.djígeʔ]

In the last stress group within the final pause group of utterance 8, prominence occurs on the final syllable and has been manifested by a glottal stop closure. However, secondary stress remains on the initial syllable of the same stress group. This is due to the presence of a preceding unstressed open syllable. This behaviour is quite general (though not universal), and many more examples can be observed in the lists in section 5.2., and in other sections.

I will now comment on intonation contours (that is, pitch) and speed of articulation. Repeated information is usually articulated more quickly than normal, and the first item of new information receives a very prominent stress pulse. In utterance 8, this occurs in the second stress group; the initial syllable of /Yatjilimiri/ being strongly pulsed. 'List intonation' involves 'level' (that is, not falling or rising) pitch on the final syllable of each list item, and falling pitch on the final syllable of the last item in the list. In utterance 8, the word ['ma:ḻu:] *'daddy'* is the first item in a list, so it receives a very strong stress pulse on the first syllable, with level pitch on the final syllable. The next pause group is the next list item, and has level pitch on the final syllable; but the pause group following is the last item in the list, and thus has falling pitch on the final syllable. An examination of the interaction of pitch (whether falling or non-falling) with glottal stop and vowel length, on the syllable preceding a pause, reveals a positive correlation between non-falling pitch and vowel length and between falling pitch and glottal stop. I will have to leave this to a study of higher level phonology, but it does appear that falling pitch on the pause group final syllable normally takes a glottal stop closure if the syllable is open; while non-falling pitch normally takes a lengthened vowel in the same environment.

If this is so, then the 'optional' rules that I will give below will really be governed by pitch. Actually, there are three distinctive pitch contours: rising (used in questions that lack an interrogative word, and sometimes on the final syllable of a pause group containing 'setting' information, such as the first pause group of utterance 6); level (used in list intonation, or as a device to indicate that the speaker is thinking of what he intends to say next); falling (normally is used preceding pause, or utterance final).

For the reader who is interested in the pitch contours on the syllable preceding a pause in utterances 1 through 8, I will give the information below. The arrows refer to rising pitch (↑), falling pitch (↓), and level pitch (→).

1. [↓]

2. [↓] (2(a) and 2(b))

3. [↓]

4. [→ / → / ↓]

5. [→ / → / ↓] (5(a) and 5(b))

6. [↑ / ↓]

7. [→ / → / → / ↓]

8. [→ / → / → / → / → / ↓ / ↓ / ↓]

We are now in a position to state some of the observations of this and preceding sections in the form of ordered rules. The rules for stress group boundary placement within a word, prominence placement,[28] and some of the prominence shifting rules will be left till section 7. The rules below pertain to the observations made in this section. The rules are to be regarded as obligatory unless marked otherwise.

Up to this point, I have been using the symbol '#' rather loosely; calling it a 'stem boundary' in some places, and a 'word boundary' in others. Before proceeding to state rules, it is necessary to define the symbols for boundaries more precisely. In the 'readjustment' component (Chomsky and Halle 1968:13), which converts syntactic surface structures into phonological surface structures, certain conventions operate to prepare the string for input to the phonological component of the grammar. Some of the readjustment rules will convert '#' boundaries into morpheme boundaries '+', this process being governed by dominating lexical or grammatical categories. I will take up this point again in the discussion of reduplication, in section 7.2. However, some conventions need to be stated in the present section. Readjustment rules for Djinang will convert word-internal '#' boundaries into '+' boundaries. Hence, the verb /djamadjigi/ *'work'*, which is syntactically $[_{\text{verb}}$#djama#dji#gi#$]_{\text{verb}}$, will be converted to $[_{\text{verb}}$#djama+dji+gi#$]_{\text{verb}}$. The symbol '#' will then represent true word boundaries only. Also, a phonological word (that is, a pause group), will be delimited by ##. Hence, between grammatical words in a phonological word, only one '#' symbol will occur; while '##' will occur at the coda of a pause group. These conventions are necessary because later phonological rules will change '#' to '.'; while '##' will be changed to '\' which is, phonetically, a pause, or silence.

glottal as prominence in durative

$$\underset{1}{[1\text{ stress}]}\ \underset{2}{\begin{bmatrix}-\text{seg}\\-\text{glot}\end{bmatrix}}{}^{29}\Big]_{\text{DA}}{}^{30} \rightarrow \begin{bmatrix}1\\-\text{stress}\end{bmatrix}\begin{bmatrix}2\\+\text{glot}\end{bmatrix}$$

pre-pause prominence[31]

$$[-\text{stress}] \rightarrow [2\text{ stress}] \;/\; \begin{bmatrix}\_\_\_\\+\text{syll}\end{bmatrix} \backslash$$

high vowel lowering in prominent syllable (optional)

$$[+\text{high}] \rightarrow [-\text{high}] \;/\; \begin{bmatrix}\_\_\_\\1\text{ stress}\end{bmatrix}$$

This rule does not apply as often in a closed syllable as it does in an open syllable. Also, it rarely applies following lamino-postalveolars (/dj/, /tj/, /ñ/ and /y/).

high vowel lowering before pause (optional)

$$[+\text{high}] \rightarrow [-\text{high}] \;/\; \begin{bmatrix}\_\_\_\\2\text{ stress}\end{bmatrix} \backslash$$

vowel lengthening by prominence (optional)

$$[-\text{long}] \rightarrow [+\text{long}] \;/\; \begin{bmatrix}\_\_\_\\1\text{ stress}\end{bmatrix} \begin{Bmatrix}\#\\CV\end{Bmatrix}$$

vowel lengthening before pause (optional, but perhaps influenced by pitch)

$$[2\text{ stress}] \rightarrow [+\text{long}] \;/\; \_\_\_ \;\backslash$$

glottal as prominence before pause (optional, but perhaps influenced by pitch)

$$\emptyset \rightarrow \begin{bmatrix}-\text{seg}\\+\text{glot}\end{bmatrix} \;/\; [2\text{ stress}]\ \_\_\_ \;\backslash$$

prominence realisation as stress (see note 31)

$[2 \text{ stress}] \rightarrow [-\text{stress}] \,/\, \underline{\quad\quad} \; [-\text{seg}]$

This rule states that prominence is not manifested as (phonetic) stress in the presence of a following boundary. The rules which precede this rule will have caused the secondary prominence to have been manifested by high vowel lowering, or glottal stop, and so forth. Thus this rule ensures that stress is not a manifestation of prominence preceding a boundary. Since the rule does not affect prominent syllables that are followed by another segment, such prominent syllables will retain the [αstress] feature (where α = 1 or 2) and then be interpreted as stressed syllables at the completion of the transformational cycle.

Finally, if 'pre-pause prominence' has been applied, then of the three rules 'high vowel lowering before pause', 'vowel lengthening before pause', and 'glottal as prominence before pause', at least **one** of these rules must be applied; and in addition, only one of the last mentioned two rules. This is because there is always **some** marking of prominence before pause; but it never (or rarely) involves both glottal stop and vowel length together.

6.2. *ALTERNATING PROMINENCE PEAKS*

Dixon (1977) has shown that in Yidiny (a Queensland language unrelated to Djinang) there is an alternation of form 'stressed syllable-unstressed syllable' (or vice-versa) within words. This has various implications in Yidiny phonology, one of which is that vowel length becomes almost completely predictable, being associated with stressed syllables. Furthermore, he states (1977:22) **"a grammatical word consists of a whole number of (one or more) phonological words"**. His "phonological word" is what I have been calling, in Djinang, a stress group; that is, a rhythmic unit larger (generally) than the syllable, but smaller than the word. Also, on the same page, he points out that the rhythmic segmentation of a grammatical word may, or may not, coincide with the morpheme boundaries in the word. These phenomena are strikingly like those found in Djinang. I am indebted to Dixon for his observation of the alternating pattern of syllable stress. It is this observation which enables us to explain the function of certain 'adjustment' rules that are required in the set of Djinang rhythmic segmentation rules (that is, the rules for placing the stress group boundary '.').

In Djinang, grammatical words very often segment rhythmically into alternating greater-stressed and lesser-stressed syllables. The picture is more complex than that given by Dixon (1977), because in Djinang there are two degrees of stress, rather than one as in Yidiny. Also, gemination of voiceless stops introduces an added complexity, producing distortions in what we might call the 'natural' patterns of rhythmic segmentation. What this means in terms of rules, is that we must supply a set of 'adjustment' rules while performing rhythmic segmentation in order to 'normalise' the patterns of alternations of stress (actually, of prominence) in the output string. At first, one may be inclined to regard these 'adjustment' rules as *ad hoc* devices required by an inadequate analysis; but a closer examination reveals that they conspire to maintain natural rhythmic patterns in Djinang utterances.

7. RULES AND RULE ORDER

7.1. *RULES FOR STRESS GROUPS AND PROMINENCE*

I will discuss the rules in the order in which they will appear in the transformational cycle. Instead of writing [-syll] and [+syll], which makes the rules harder to read than is necessary, I will use C and V, respectively. For boundary symbols, I will use the symbols, ##, #, +, ., and \; except that for glottal stop I will use the feature bundle $\begin{bmatrix}\text{-seg}\\ \text{+glot}\end{bmatrix}$. All boundary symbols are [-seg].[32] Rules will be named, and numbered. The symbol 'OPT' signifies an optional rule.

Chomsky and Halle (1968:16) state the convention "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." I have not found this convention to be necessary, or even desirable, in Djinang phonology. I have not used it in the rules.

Before I list the rules, I will make some general comments about them. Firstly, the rules do not generate all the possible terminal strongs. For example, I have not given a rule that permits prominence to shift to the second syllable in /indjir̃/ ['in.djír̃] ∿ [ín.'djir̃] *'not I'*. Examples like this are rare, and are confined to forms lacking an initial consonant. Hence, the rules I have given are intended to account for the majority of terminal (phonetic) strings. There are some 'weaknesses' in the formalism, particularly with respect to the notion of an 'optional' rule. Actually, although the rules listed as optional are indeed 'optional' in the strict sense of the word, the application of any one rule is not a random variable. A principle is involved, or a conspiracy, so that optional rules are invoked in circumstances that will produce a maximally natural alternation of primary stressed, secondary stressed, and unstressed syllables.

I have also included a few rules that I have not discussed previously in the discussion of the data. One is a vowel elision rule (rule 16), since forms such as /katjini ki͟rim/ *'holding on'* (habitual) are always articulated as ['kat͡j.tjín.'ki·ri͟m]. Another (rule 23), frequently changes /i/ to [u] in the contexts p_gi#, ŋ_pm#, and so forth. For example, /milikipm/ ['meli.kúp̆.m] ∿ ['meli.kíp̆.m] *'just have a look'*.

Another device I have employed is angled brackets (Hyman 1975:120) to indicate co-occurrence. I have used it in rule 18 (in a non-standard way - but, I believe, with an obvious meaning) to state that if, and only if, the feature [+narr] is present does the change . → Ø occur. However, the changes shown in the remainder of rule 18 are independent of whether [+narr] is present or not. Rule 18 accounts for words like /bilayili/ [bí'layile] *'to a distant place'*, and /d͟iřadjigi/ [d͟í'řa.djige] *'eat'*; where secondary prominence has shifted to the final syllable because primary prominence has been shifted, previously, on to the second syllable. In the former word, the stress group boundary '.' is deleted when it precedes a glide ([+dist, +narr]), making the word just one rhythmic unit with two prominent syllables.

The rules may be divided into groups in which all the rules in a group are performing a similar function. The first rule rewrites ## as a pause boundary, then there is a 'segmental' rhythm adjustment accomplished by the progressive gemination rule. This rule geminates a voiceless stop, providing a non-syllabic onset for a following vowel-initial morpheme. This ensures correct segmentation into rhythmic units. Thus, if this rule were not ordered before the rhythmic segmentation rule, /dja͟rakipm/ *'just a spear'* would be segmented as [dja͟ra.kip.m], leading to the deviant output *['dja͟ra.kúp̆.m]. The progressive gemination rule derives dja͟rakkipm, which will be segmented as dja͟rak.kip.m leading to the correct form ['dja͟rak̆.kúp̆.m].

Following this are the rhythmic segmentation rules (rules 3 to 8). Sequences of up to five open syllables are found in Djinang; and most of these rules specify how to segment sequences of from three to five open syllables (rules 4 to 8). Segmentation of closed syllables is performed by rule 3 which places a '.' between the relevant consonants. An important, and obvious, feature of these rules is that Djinang uses basically two mechanisms for rhythmic segmentation: firstly, consonant clusters (including those produced by gemination, rule 13) and secondly, by the distribution of the feature 'distributed' in segments. The latter fact is reflected by the occurrence of [+dist] in every rule except rule 3, and this no doubt explains why distributed consonants are so frequently used in stems and affixes. In fact, these rules predict that a suffix beginning with a non-distributed consonant will 'cohere' with the stem (compare 'cohering' and 'non-cohering' affixes in Dixon 1977:27), while suffixes beginning with a distributed consonant may be an entire rhythmic unit (that is, be 'non-cohering'), or at least commence a rhythmic unit. Thus [+dji+gi] 'verbaliser and non-past tense' are usually one rhythmic unit /.djíge./. Examination of the rules 4 through 8 also reveals that the 'preferred' rhythmic unit is disyllabic; while a tri-syllabic rhythmic unit is tolerated only if the third consonant is non-distributed.

Then follow the rules for assigning primary prominence (using the feature 1 stress which, as I explain in note 31, refers to prominence in pre-terminal strings, but stress in a terminal string), and secondary prominence, and for shifting prominence in the presence of an /a/ vowel. It is either gemination or this occasional shifting of prominence on to the second syllable of a word that necessitates 'adjustment' rules to re-order the prominence assignments on syllables, so that the correct sequence of greater prominent and lesser prominent syllables is obtained.

The interaction of the prominence placement rules with rule 33 is interesting. Rule 33 is # → . / ____ [+seg], and it changes all word boundaries into stress group boundaries at the completion of the first pass through the transformational cycle. By doing this, the application of primary prominence placement is blocked on all subsequent cycles. This is necessary since rule 12 can shift prominence after it is placed in a stress group, and it must not happen that prominence is placed on the first syllable of a stress group during the **second** cycle if shifting has occurred on the **first** cycle - this would result in a sequence of two syllables with the same degree of prominence. This is illegal, as it violates the principle of alternating degrees of stress (see section 6.2.). Thus, changing '#' to '.' at the end of the first cycle blocks the primary prominence placement rule thereafter. Although rule 11 allows for secondary prominence to be assigned on the second cycle, in actual fact it can be applied in the second cycle only if gemination has occurred, and, the second of the stress groups produced by this gemination is two syllables in length (see the example given below). This is due to the feature [+seg] in the specification of the environment. This has the effect of never permitting secondary prominence to be placed on a **.CV.** stress group, although all other stress group types (see section 5.1.) satisfy the condition for application of the rule. Since a **.CV.** stress group is never stressed in Djinang (although it may manifest prominence before a pause - but only by a glottal stop, or lowered vowel, or both), this is precisely the behaviour we want. To show why secondary prominence placement, on the second cycle, requires prior gemination, I shall take an example. Consider the word /bapili/ *'to here'* which is articulated as ['bap̆.pile], and let us trace a portion of its derivation. The rules for rhythmic segmentation segment a string exhaustively on the first cycle, with the exception of words that undergo the gemination rule. Thus, /bapili/ is unsegmented at the completion of the first cycle, and at that point it is 'bappili (ignoring non-essential rules for the present). There has been no secondary prominence placement at this stage, because the cluster segmentation rule (rule 3) has not yet been applied. Then, on the second cycle we get 'bap.pili (rule 3), then 'bap.píli (rule 11), thereby placing secondary prominence. However, there is now an 'imbalanced' sequence of prominent syllables (produced by the prior gemination), and so an 'adjustment' rule (rule 21) shifts the secondary prominence to the last syllable ('bap.pilí) where it is subsequently realised as a lowered high vowel followed by a glottal closure, hence ['bap̆.pileʔ].

If we did not change all occurrences of '#' to '.' at the end of the first cycle (by rule 33), then we would have to prevent re-application of the rules for prominence placement after prominence shifting has occurred by making the prominence placement rules more complicated. In fact, rules 10 and 11 would then be

$$*[-\text{stress}] \rightarrow [1\ \text{stress}] \Big/ \#(\text{C})\_\_\_ \left\{ \begin{matrix} \begin{bmatrix} -\text{seg} \\ -\text{glot} \end{bmatrix} \\ \text{C(C)} \left\{ \begin{matrix} [-\text{stress}] \\ \left\{ \begin{matrix} \# \\ \backslash \\ \text{C} \end{matrix} \right\} \end{matrix} \right\} \end{matrix} \right\}$$

and

$$*[-\text{stress}] \rightarrow [2\ \text{stress}] \Big/ \left\{ \begin{matrix} \# \\ . \end{matrix} \right\} \text{C} \begin{bmatrix} \_\_\_ \\ -\text{schwa} \end{bmatrix} \left\{ \begin{matrix} \left\{ \begin{matrix} \backslash \\ \# \end{matrix} \right\} \\ \text{C(C)} \left\{ \begin{matrix} \begin{bmatrix} -\text{seg} \\ -\text{glot} \end{bmatrix} \\ [\alpha\text{stress}] \end{matrix} \right\} \end{matrix} \right\}$$

where α = 1 or -

It is clear that rule 33 has a marked simplifying effect on these rules. Hence, this constitutes a very strong claim that, in Djinang phonology at least, the change from word boundaries to rhythmic boundaries must be accomplished before the onset of the second cycle.

Rules 14 and 15 handle the durative aspect morpheme (placement of glottal stop) and schwa placement. Rule 16 is a vowel elision rule.

The rules 17 to 21 are 'adjustment' rules which alter the sequence of prominent and non-prominent syllables when necessary.

Rule 22 makes the third syllable prominent in a stress group of form .C[αstress]C[-stress]CV(C)., where α = 1 or 2. This is allowed because the medial syllable is non-prominent. However, when the stress group ends in a vowel, the prominence will either result in a lowered high vowel (by rule 26) or be unmodified - and then deleted by rule 32; but if the stress group ends in a consonant, both rule 26 and rule 32 are blocked and the prominence is realised as (phonetic) stress. Although such stress groups are quite rare, all the data that I have supports this:

/butji butpiŋir̲aŋ/	['bot̚j.tji. 'bot̚.píŋir̲áŋ]	*'it's about to get away'*
/bubalikin̲iŋ/	['bubale.kín̲iŋ]	*'any time'*
/bubalikin̲im/	['bubali.kín̲im]	*'anywhere'*

The above mechanism is a way where there can be two prominent syllables in one stress group. Normally, the final prominence is realised as a lowered vowel, so that there is only one (phonetic) stress on the stress group, but for a stress group of form .CVCVCVC., a secondary (phonetic) stress may occur on the last syllable (refer to note 19).

Another of the environments allowed by rule 22 is .C[αstress]C[-stress].C___(C)., where α = 1 or 2, which arises from rule 4. If the second pause group in this structural description were .CV., the secondary prominence placement rule (rule 11) would not place prominence on this one-syllable open stress group. Yet words with prominence in such a position are common: for example /kaliki/ ['kali.keʔ] *'have'*. The condition of alternating degrees of prominence (or stress) implies that the final syllable of a word like /kaliki/ is permitted to be prominent. Thus rule 22 places secondary prominence in the last syllable of such forms, which is later realised as high vowel lowering, glottal stop closure, or both, in the appropriate environments (rules 26, 27, 28). If none of the rules realise prominence in such ways, then rule 32 deletes the secondary prominence so that it does not occur as (phonetic) stress.

Finally, rule 22 also allows an environment of form .C[αstress]C.C[-stress].C___., where α = 1 or 2, and in which the final .CV. is not prominent (since rule 11 is blocked). Again, prominence can be manifested in the final stress group, in line with the alternating degrees of prominence condition; and rule 22 accomplishes this. Such an environment occurs only rarely and is only produced by a prior gemination. One example is in utterance 1 of section 6.1.:

/djambakugi/ ['djam.bák̚.ku.ge.] *'tobacco'* (dative)

The rules segment this and place prominence as follows: 'djam.báku.gi, then 'djam.bák̚.ku.gi. Then rule 22 places secondary prominence on the final syllable, to obtain ['djam.bák̚.ku.ge.], as in utterance 1 of section 6.1.

After rule 22, come a group of rules (rules 23 to 32) which modify segments. Most of these rules function to cause prominence to be manifested as a lowered high vowel, or length, or a glottal stop closure, or as stress. Then lastly, the rule changing '#' to '.' completes the cycle (rule 33).

Rules 28 and 29 are formally very similar, being:

$$[-\text{long}] \rightarrow [+\text{long}] \,/\, \left[\begin{array}{l} \overline{} \\ 2\ \text{stress} \end{array}\right] \backslash \ \text{OPT, and}$$

$$[-\text{long}] \rightarrow [+\text{long}] \,/\, \left[\begin{array}{l} \overline{} \\ 1\ \text{stress} \end{array}\right] \begin{Bmatrix} \# \\ \text{CV} \end{Bmatrix} \ \text{OPT.}$$

However, they cannot be combined as one rule. The second of these handles forms like ['bo:] *'faeces'*, and ['me:dji?] *'grandmother'*; while the first rule accounts for the lengthened vowel in the first pause group of utterance 7 section 6.1.

As can be seen from utterances 1 through 8 in section 6.1., glottal stop occurs phonetically before a pause. However I have claimed that both are boundaries. Wood (1978) indicates that it is perhaps best to view glottal stop as a segmental unit, but it nevertheless functions as a prosody of the syllable. I have had to complicate the rules, given below, to a certain extent because of the assumption that glottal stop is [-segment]. It would be far more convenient to define a feature 'boundary symbol', so that all the boundary symbols (\, #, ?, ., +) will be specified as [+boundary symbol], but that '\' and '?' be specified as [+segment] while the other boundary symbols would be [-segment].

This would, for example, allow rules to treat glottal stop as a segment, or as a boundary symbol, in circumstances where it has a double function - which is the case in Gaalpu (Wood 1978) and Djinang. In Djinang, it functions like a segmental syllable closure to manifest prominence, parallelling the behaviour of a geminated voiceless stop to provide closure for a preceding prominent open syllable. But it also has a secondary 'demarkative' function, when it occurs between a (reduplicated) durative morpheme and the following stem. This 'demarkative' function is very much more evident in other Yolngu languages (for example, Gupapuyngu, Gaalpu as shown by Wood 1978) than it is in Djinang.

I have adopted the following conventions regarding the application of optional and obligatory rules in any one pass of the transformational cycle. Each obligatory rule is applied repeatedly to the string until there are no more environments available that satisfy the structural description (or descriptions) of that rule, and only then may the next rule of the cycle be applied to the string. If any rule has various options for the structural description, then these are expanded in the normal way, but each such option must be exhaustively applied to the string until there are no suitable environments remaining; after that, the next option of the structural description is considered, and so forth. Optional rules are handled similarly, except that the application of the rule in a suitable environment is not obligatory. Thus, the cycle may end only when no obligatory rules can be applied, even though optional ones may still qualify for application.

In the following rules, the feature 'FB' refers to a formative boundary (Chomsky and Halle 1968:364).

(1) pause boundary

$$\underset{1}{\#}\ \underset{2}{\#} \rightarrow \begin{bmatrix}1\\ \diagdown\end{bmatrix}\ \emptyset$$

(2) progressive gemination

$$\emptyset \rightarrow \begin{bmatrix}\alpha\text{dist}\\ \beta\text{periph}\\ \gamma\text{ant}\\ -\text{son}\\ -\text{voice}\end{bmatrix} \Big/ \begin{bmatrix}\alpha\text{dist}\\ \beta\text{periph}\\ \gamma\text{ant}\\ -\text{son}\\ -\text{voice}\end{bmatrix} + \_\_\_\ \text{V}$$

where α, β, γ = + or -

(3) cluster segmentation

$$\emptyset \rightarrow .\ \Big/ \begin{bmatrix}\#\\ .\end{bmatrix}\ \text{X (C)C}\ \_\_\_\ \text{C Y} \begin{bmatrix}\#\\ .\end{bmatrix}$$

where X and Y contain no internal occurrence of # in the first subrule, and '.' in the second subrule.

(4) normal segmentation (optimal pattern)

$$\emptyset \rightarrow .\ \Big/ \begin{Bmatrix}\#\\ .\end{Bmatrix}\ \text{CVCV}\_\_\_[+\text{dist}]\ (\text{VC}(\text{VC}))\text{V}(\text{C}) \begin{bmatrix}-\text{seg}\\ -\text{glot}\\ -\text{FB}\end{bmatrix}$$

(5) four and five syllable segmentation (alternative pattern)

$$\emptyset \rightarrow .\ \Big/ \begin{Bmatrix}\#\\ .\end{Bmatrix}\ \text{CVCV}\ [-\text{dist}]\text{V}\_\_\_[+\text{dist}]\ (\text{VC})\text{V}(\text{C}) \begin{bmatrix}-\text{seg}\\ -\text{glot}\\ -\text{FB}\end{bmatrix}$$

(6) four syllable segmentation (adjustment)

$$+ \rightarrow .\ \Big/\ \text{C.CV}\_\_\_[+\text{dist}]\ \text{VCVCV}(\text{C}) \begin{bmatrix}-\text{seg}\\ -\text{glot}\\ -\text{FB}\end{bmatrix}$$

(7) three syllable segmentation (adjustment)

$$+ \rightarrow . \;/\; \left\{\begin{matrix}\#\\ \text{C.}\end{matrix}\right\} \text{CV}\_\_\text{[+dist]V[-dist]V(C)} \begin{bmatrix}\text{-seg}\\ \text{-glot}\\ \text{-FB}\end{bmatrix}$$

(8) three syllable segmentation (optional adjustment)

$$+ \rightarrow . \;/\; \text{C.CV}\_\_\text{[+dist]VCV(C)} \begin{bmatrix}\text{-seg}\\ \text{-glot}\\ \text{-FB}\end{bmatrix} \quad \text{OPT}$$

(9) formative boundary deletion

$$+ \rightarrow \emptyset$$

(10) primary prominence placement

$$\text{[-stress]} \rightarrow \text{[1 stress]} \;/\; \#\text{(C)} \begin{bmatrix}\_\_\\ \text{V}\end{bmatrix}$$

(11) secondary prominence placement

$$\text{[-stress]} \rightarrow \text{[2 stress]} \;/\; \text{.C}\_\_\text{[+seg]}$$

(12) prominence shifting

$$\underset{1}{\begin{bmatrix}\text{-low}\\ \alpha\text{stress}\end{bmatrix}} \; \underset{2}{\text{[+voice]}} \; \underset{3}{\text{[+low]}} \rightarrow \begin{bmatrix}1\\ \text{-stress}\end{bmatrix} \; 2 \; \begin{bmatrix}3\\ \alpha\text{stress}\end{bmatrix} \quad \text{OPT}$$

where α = 1 or 2

(13) regressive gemination

$$\emptyset \rightarrow \begin{bmatrix}\alpha\text{dist}\\ \beta\text{periph}\\ \gamma\text{ant}\\ \text{-son}\\ \text{-voice}\end{bmatrix} \;/\; [\delta\text{stress}]\_\_\text{(.)} \begin{bmatrix}\alpha\text{dist}\\ \beta\text{periph}\\ \gamma\text{ant}\\ \text{-son}\\ \text{-voice}\end{bmatrix} \text{V}$$

where α, β, γ = + or −, and δ = 1 or 2

(14) glottal as prominence in durative

$$\underset{1}{\text{[1 stress]}} \left[\underset{2}{\begin{bmatrix}\text{-seg}\\ \text{-glot}\end{bmatrix}}\right]_{DA} \rightarrow \begin{bmatrix}1\\ \text{-stress}\end{bmatrix}\begin{bmatrix}2\\ \text{+glot}\end{bmatrix}$$

(15) schwa[33]

$$\text{V} \rightarrow \text{[+schwa]} \;/\; \#\text{[-son]} \begin{bmatrix}\_\_\\ \text{-low}\\ \text{-stress}\end{bmatrix} \quad \text{OPT}$$

(16) vowel elision

$$\text{[-back]} \rightarrow \emptyset \;/\; \text{C.C[2 stress]} \begin{bmatrix}\text{-dist}\\ \text{+son}\end{bmatrix}\begin{bmatrix}\_\_\\ \text{-stress}\end{bmatrix} \text{C[1 stress]}$$

(17) class III verb pattern change (optional)

$$\begin{array}{llllllllll} \text{C} & . & \text{C} & [\text{-back}] & . & \begin{bmatrix}\text{+dist}\\ \text{-periph}\\ \text{-son}\\ \text{+voice}\end{bmatrix} & \begin{bmatrix}\text{-back}\\ \text{2 stress}\end{bmatrix} & \begin{bmatrix}\text{+dist}\\ \text{-periph}\\ \text{-son}\\ \text{+voice}\end{bmatrix} & [\text{-back}] & \begin{Bmatrix}\backslash\\ .\end{Bmatrix} \text{ OPT}\\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \rightarrow\\ 1 & 2 & 3 & \begin{bmatrix}4\\ \text{2 stress}\end{bmatrix} & \emptyset & \begin{bmatrix}6\\ \text{+narr}\end{bmatrix} & \begin{bmatrix}7\\ \text{-stress}\end{bmatrix}. & 8 & \begin{bmatrix}9\\ \text{2 stress}\end{bmatrix} & 10 \end{array}$$

Rule 17 permits a word such as /kut̲idjidji/ *'be sated'* to be articulated either as [ˈkut̲̆.t̲i.djídje] or as [ˈkut̲̆.t̲íyi.djeʔ]. Both of these patterns are common, particularly the latter one; for example /biřmiřidji/ [ˈbiř.míři.djeʔ] *'sing'*.

(18) coalescence (four syllables)

$$\begin{array}{lllllllll} \text{V} & [\text{-dist}] & \begin{bmatrix}\text{+low}\\ \text{1 stress}\end{bmatrix} & . & \begin{bmatrix}\text{+dist}\\ \text{<+narr>}\end{bmatrix} & [\text{2 stress}] & \text{C} & \text{V} & \begin{Bmatrix}\backslash\\ \#\end{Bmatrix}\\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \rightarrow\\ 1 & 2 & 3 & \text{<}\emptyset\text{>} & 5 & \begin{bmatrix}6\\ \text{-stress}\end{bmatrix} & 7 & \begin{bmatrix}8\\ \text{2 stress}\end{bmatrix} & 9 \end{array}$$

(19) alternation adjustment 1

$$\begin{array}{lllllllll} \text{C} & . & \text{C} & [\text{2 stress}] & \text{C} & [\text{-stress}] & [\text{-dist}] & \text{V} & \begin{Bmatrix}\backslash\\ \#\end{Bmatrix}\\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \rightarrow\\ 1 & 2 & 3 & \begin{bmatrix}4\\ \text{-stress}\end{bmatrix} & 5 & \begin{bmatrix}6\\ \text{2 stress}\end{bmatrix} & 7 & 8 & 9 \end{array}$$

(20) coalescence (three syllables)

$$. \rightarrow \emptyset \;/\; [\text{2 stress}]\ [\text{-dist}]\ [\text{1 stress}]\ \_\_\_\ [\text{+son}]\ \text{V} \begin{Bmatrix}\backslash\\ \#\end{Bmatrix}$$

(Rule 20 could be ordered before rule 19)

(21) alternation adjustment 2

$$\begin{array}{lllllllll} [\alpha\text{stress}] & \text{(C)C} & . & \text{C} & [\text{2 stress}] & \text{C} & [\text{-stress}] & & \begin{Bmatrix}\backslash\\ .\text{(C)}[\text{-stress}]\end{Bmatrix}\\ 1 & 2\ 3 & 4 & 5 & 6 & 7 & 8 & & 9 \rightarrow\\ 1 & 2\ 3 & 4 & 5 & \begin{bmatrix}6\\ \text{-stress}\end{bmatrix} & 7 & \begin{bmatrix}8\\ \text{2 stress}\end{bmatrix} & & 9 \end{array}$$

where α = 1 or 2

(22) alternation adjustment 3

$$[\text{-stress}] \rightarrow [\text{2 stress}] \;/\; .\text{C}[\alpha\text{stress}]\ ((\text{C})\text{C}.)\text{C}\ [\text{-stress}]\ (.)\text{C}\_\_\_(\text{C}).$$

where α = 1 or 2

(23) pre-pause prominence

$$[\text{-stress}] \rightarrow [\text{2 stress}] \;/\; \left[\overline{\quad}\ \text{V}\right] \backslash$$

(24) vowel backing

$$[-\text{back}] \rightarrow [+\text{back}] \,/\, \begin{bmatrix} +\text{periph} \\ -\text{cont} \\ \alpha\text{back} \end{bmatrix} \underline{\quad\quad} \begin{bmatrix} +\text{periph} \\ -\text{cont} \\ -\alpha\text{back} \end{bmatrix} [+\text{son}] \begin{Bmatrix} \backslash \\ \# \end{Bmatrix} \quad \text{OPT}$$

where α = + or -

(25) word-final vowel lowering

$$[+\text{high}] \rightarrow [-\text{high}] \,/\, \begin{Bmatrix} \# \\ . \end{Bmatrix} (\text{C}) \; [\alpha\text{stress}] \; (\text{CV})\text{C}\underline{\quad}\#$$

where α = 1 or 2

(26) high vowel lowering before boundaries (except '+', see rule 9)

$$[+\text{high}] \rightarrow [-\text{high}] \,/\, \begin{bmatrix} \underline{\quad\quad} \\ 2 \text{ stress} \end{bmatrix} [-\text{seg}] \quad \text{OPT}$$

(This rule has been generalised slightly, in comparison to the rule presented in section 6.1.)

(27) glottal as prominence before pause

$$\emptyset \rightarrow \begin{bmatrix} -\text{seg} \\ +\text{glot} \end{bmatrix} \,/\, [2 \text{ stress}] \underline{\quad\quad} \backslash \quad \text{OPT}$$

(28) vowel lengthening before pause

$$[2 \text{ stress}] \rightarrow [+\text{long}] \,/\, \underline{\quad\quad} \backslash \; \text{OPT}$$

(29) vowel lengthening by prominence

$$[-\text{long}] \rightarrow [+\text{long}] \,/\, \begin{bmatrix} \underline{\quad\quad} \\ 1 \text{ stress} \end{bmatrix} \begin{Bmatrix} \# \\ \text{CV} \end{Bmatrix}^{34} \quad \text{OPT}$$

(30) high vowel lowering in prominent syllable

$$[+\text{high}] \rightarrow [-\text{high}] \,/\, \begin{bmatrix} \underline{\quad\quad} \\ 1 \text{ stress} \end{bmatrix} \quad \text{OPT}$$

(31) obstruent truncation

$$[-\text{son}] \rightarrow \begin{bmatrix} -\text{voice} \\ +\text{held} \end{bmatrix} \,/\, \underline{\quad\quad} \begin{Bmatrix} [-\text{seg}] \\ \text{C} \end{Bmatrix}$$

(This rule assumes that a [+held] consonant will be specified as [-delayed release] by a redundancy)

(32) prominence realisation as stress

$$[2 \text{ stress}] \rightarrow [-\text{stress}] \,/\, \underline{\quad\quad} [-\text{seg}]$$

(33) word boundary metamorphosis

$$\# \rightarrow . \,/\, \underline{\quad\quad} [+\text{seg}]$$

End of cycle.

7.2. *REDUPLICATIONS*

In section 5.2. I stated that in reduplications the stress pattern of the stem is repeated in the reduplicated part. Thus /buwalbuwaldjigi/ *'bubbling water'* is articulated as [bú'wal.bú'wal.djigeʔ]. The approach I am using is that on input to the phonological cycle such a word would be represented by the string #buwal#buwal+dji+gi#. That is, the '#' boundary between the reduplicated parts is maintained as a full word boundary and not changed by the re-adjustment component, while the '#' boundary between buwal and dji is changed to a morpheme boundary '+'. In this way, the cyclic rules will segment and assign stress on each of the reduplicated parts in an identical manner (although some extra constraints on the rules must apply - namely: if rule X applies to the first stem, then it must also apply to the second stem).

That the above string is a verb can be recovered from the labelled bracketing, if desired. The string will be specified as:

$[_{verb}$ buwal $[_{verb}$ buwal dji gi $]_{verb}$ $]_{verb}$

Reduplications such as the above will, I expect, be generated in the syntax. Certain reduplicated forms, however, will be lexical. For example, /bulgabulga/ ['bul.ga.'bul.gaʔ] *'lily'*, is not (as far as I know) semantically segmentable. For the phonology to handle the stress pattern of such forms, they would need to be stored in the lexicon as a sequence of two words.[35]

Although durative aspect in a verb will be realised with a reduplication of the first two segmental phonemes of the stem, the stress pattern of the stem is not repeated in the reduplicated part. The approach I have taken for duratives is that there is underlying prominence on the reduplicated part, which is realised as a post-positioned glottal stop after the reduplicated CV which forms the durative morpheme. Presumably the syntax and morphophonemics will handle the reduplication on the first consonant and vowel. However, in this case, there will need to be unique labelled brackets assigned to the durative aspect morpheme in order to satisfy the conditions for input to the 'glottal as prominence in durative' rule (rule 14). Hence, /ŋu-ŋuri/ *'is sleeping'*, will be labelled as:

$[_{verb}$ $[_{DA}$ ŋu $]_{DA}$ $[_{verb}$ ŋuri $]_{verb}$ $]_{verb}$

Providing these conditions are adhered to, the rules of section 7.1. will handle reduplicated forms correctly.

7.3. *COMMENTS ON GEMINATION IN REMBARNGA*

Given that the distribution of gemination of voiceless stops is predictable in Djinang, the question to be asked now is whether gemination of voiceless stops is similarly predictable in other languages. McKay (1975) has studied gemination in Rembarnga, giving reasons for an analysis which interprets surface voiceless stops as underlying geminate stop clusters. In this section I will show that there is good evidence (based on the material in McKay's 1975 thesis) that the same or very similar conditioning factors produce geminated voiceless stops in Rembarnga as they do in Djinang. All references in this section to McKay refer to his 1975 thesis; references to page numbers refer to the same work. "... there appears to be a voicing distinction for the oral stop phonemes. Word initially, intervocalically, and after liquids and semivowels this contrast occurs." (p.17)

There are basically two approaches that an investigator can take when faced with a voiced/voiceless opposition in stops that could also be interpreted as a non-geminate/geminate contrast.

Firstly, one can assume the geminate versus non-geminate distinction is the underlying contrast, and posit various rules to voice (or not voice) surface realisations of ungeminated voiceless stops in certain environments.

Secondly, one can assume the voiced/voiceless distinction is the underlying contrast, and posit various rules to produce gemination of voiceless stops in certain environments.

McKay has taken the former approach, and I have taken the latter approach. Is one or the other of these two approaches to be preferred, or is the choice of approach arbitrary? I believe there are sound linguistic reasons why the voiced versus voiceless contrast is to be preferred as the underlying contrast. I will now deal with some of these reasons.

The geminate hypothesis used by McKay means that surface voiceless (ungeminated) stops are interpreted as underlying geminate clusters and then one member of the cluster is deleted so that the surface manifestation is merely a voiceless stop. McKay discusses environments where this occurs on p.52. He considers certain nominal affixes which he assumes have geminated voiceless stop onsets. The following quote is taken from p.52:

> The suffix initial geminate stop becomes a single stop when suffixed to a stem with one of the following:
>
> A a stem final glottalised syllable;
> B a stem final nasal consonant;

C a stem final oral stop; or
D a stem final vowel (open syllable), where the closest preceding syllable initial stop is preceded by an oral stop segment in the same stem, unless a closed syllable intervenes between the suffix and the stop.

Elsewhere the suffix initial geminate stop is not modified.

Stress in Rembarnga is normally on the initial syllable of a root (p.57), but the presence of prefixes makes the situation a little more complicated than in Djinang. However, there are numerous roots without prefixes, so a comparison with Djinang can be made. McKay does not mark secondary stress, but rather uses the same marking for both primary and secondary stress. From the data on pp.58-61, we observe that voiceless stops are never geminated when they occur as onsets of a stressed syllable. This is identical to the Djinang situation. We also find (see also pp.14-17) that a voiceless stop often (but apparently not always) geminates when it follows an open stressed syllable. Hence gemination in both Rambarnga and Djinang appears to be governed by essentially the same factors - namely, the distribution of voiceless stops in relation to open stressed syllables.

Now let us return to the quotation given before from p.52. Let us assume that rhythmic segmentation and gemination are governed by the same rules as for Djinang (as a first approximation only). Condition 'A' does not occur in Djinang, but conditions 'B', 'C', and 'D' do occur in Djinang. Conditions 'B' and 'C' are accounted for by the cluster segmentation rule (rule 3) of section 7.1. Thus secondary prominence placement (rule 11) will place secondary prominence on the first syllable of the nominal suffix. Under these conditions, gemination of the voiceless stop does not occur, since it is the onset of a stressed syllable.

Considering condition 'D', which is accurate in so far as it goes (it assumes the ungemination rule is governed by a combination of segmental and syllable pattern factors rather than by stress), we find that the rhythmic segmentation rules of section 7.1. predict precisely the behaviour outlined in condition 'D'. Examples (from p.53, but changed to my notation and with no marking of secondary stress):

[kutj.pərə.tja], from kutjpərə+tja
[pəḷp.pəḷ.ŋatj.tja], from pəḷppəḷŋa+tja

There do appear to be some departures from the Djinang norms. For example, it appears that voiceless stops can geminate when they follow a (stressed) closed syllable ending in a continuant (p.53); and it appears that stress groups may commence with non-distributed consonants (pp.61 and 62) even though a vowel precedes the stress group.

Notwithstanding the differences in relation to Djinang, there appears to be a strong case for treating Rembarnga gemination as gemination of underlying voiceless stops following stressed open syllables or following stressed closed syllables which end in a continuant.

As evidence for the gemination hypothesis, McKay explains what happens when a speaker deliberately slows an utterance down in order to articulate the syllables clearly. McKay says (p.20):

> He was very consistent, when pronouncing medial voiceless stops, in producing stop closure at the end of one syllable, releasing the closure only after the (sometimes considerable) syllable break. Where voiced stops appeared medially he would both make and release the stop closure only after the syllable break.

This is precisely what happens when Djinang speakers articulate a word syllable by syllable. In fact, Djinang speakers will geminate sonorant consonants to provide closure on a previous syllable, paralleling the behaviour of voiceless stops, under the same slow articulation conditions.

This has a very simple explanation. McKay says (p.57) "... in slow speech more stresses will be present than in fast speech ...". This is also true in Djinang. In deliberate slow speech, a speaker tries to make each syllable prominent, and therefore stresses each syllable sequentially - causing gemination to occur universally (except for voiced stops which cannot be geminated and remain lax).

Further support for the underlying voiced/voiceless interpretation is given by McKay himself (p.20):

> ... this interpretation of medial voiceless stops as geminate ... does, however, raise one difficulty connected with syllable structure .... Without this interpretation syllables with final consonant clusters can have as their final stop only a velar stop, a bilabial stop (or phonetically a glottal stop). This would apply to all syllables, irrespective of their position within the word. On the other hand if the geminate stop interpretation is adopted the above restriction would still apply to word final syllables, but all the other stops would be possible in non final syllables ending in consonant clusters. Thus, under the geminate stop interpretation there is a certain lack of generality in the statements which can be made about syllable structure.

(Compare Djinang consonant clusters in the coda of CVCC syllables, Chart 5 of section 4.3.)

The voiced versus voiceless underlying stop interpretation avoids the above difficulty with respect to medial CVCC syllables. In view of this, and in the light of the preceding discussion of gemination, it can hardly be said that having separate voiced and voiceless series of stops involves "extra complexity" (p.21). Rather, it appears that those who maintain a geminate hypothesis as the underlying contrast are the ones who must contend with greater complexity.

Since Rembarnga is a non-Pama-Nyungan language and Djinang is a Pama-Nyungan language, the similarities in the distribution of geminated stops in these languages argues for a degree of universality (to what extent is unknown) in the gemination phenomenon in Australia. The indications are that it is a surface phonetic (that is, non-contrastive) phenomenon intrinsic to Australian phonological systems generally, rather than being an underlying (that is, contrastive) opposition in certain unrelated or partly related Australian languages, such as Djinang and Rembarnga.

NOTES

1. Yolngu, which means *'people'*, is a word used extensively by Aboriginals in north-east Arnhem Land to refer to themselves. Murngic languages (Voegelin and Voegelin 1977:24), which are spoken by people in this area, are often referred to as 'Yolngu' languages.

2. Wood (personal communication) has indicated that the ideal of a communalect/clan naming dichotomy, while certainly valid in the Djinang- and Djininy-speaking area, does not extend eastwards into the main part of the Yolngu bloc.

3. It is not clear whether Manyarrngu refers to the clan, or the communalect. David Malanggi, my source of most of this information, is the leading Manyarrngu clansman; hence it may well be that in this instance the communalect and clan names coincide.

4. Wood (personal communication) believes, on lexical grounds, that this clan is really a part of the Djininy group. I have retained it in the Djinang group only because my language consultant placed it in that group.

5. I am not sure if this is a clan or communalect name.

6. That paper was written prior to the writing of 'Djinang Phonology'. Some of the features I use in this present paper are discussed in more detail in that paper.

7. Chomsky and Halle (1968:304) use the feature 'coronal' for distinguishing retroflex vowels from non-retroflex vowels, the latter being [-coronal].

8. For Yolngu languages with a lamino-alveolar (that is 'interdental') order of consonants, the relevant grouping would be the labials, velars, lamino-postalveolars and lamino-alveolars.

9. The symbol 'h' indicates a lamino-alveolar sound (that is, an 'interdental').

10. This is a slight overstatement. Word initially, neutralisation is possible, but not obligatory. Word initial voiceless stops occur frequently in text, and on words spoken in isolation. However, in text the opposition tends to be neutralised at the start of a word at the beginning of a phrase or clause, while it is uncommon for neutralisation to occur at the start of words occurring within a phrase or clause.

11. This is due to the treatment of both orders of apical stops, nasals and laterals as being retroflexed, and the orders differing only with respect to the point of articulation. As Wood notes (1978: section 1.4.2): "When speaking English, Yuulngu occasionally pronounce initial alveolars with a noticeable degree of retroflexion." Thus Lowe (1960) has very many more Gupapuyngu words beginning with /d̲/ than beginning with /d/. But many of these are cognate with Djinang words, where they are clearly alveolar rather than (retroflexed) domal.

12. Syllable boundaries will be marked by ',', since a period is used to mark stress-group boundaries.

13. The other insight is stress-groups. It is not clear if stress groups will affect Wood's (1978) conclusions about the contrastive status of Gaalpu long vowels. Certainly in Djinang, it is possible to analyse vowel length as non-contrastive. But even though vowel length in Gaalpu behaves in a similar manner to vowel length in Djinang (e.g. occurring only in a stressed syllable, which may occur only once per word, and only word initially), it is nevertheless possible that Gaalpu uses vowel length contrastively. In his paper, Wood (1978) recognises that there are stress groups in Gaalpu, but he does not attempt to relate them to glottal stop, fortis syllables, stop gemination and vowel length.

14. This constraint partly breaks down for clusters across syllable boundaries. See section 4.4.

15. Wood (1978) observes a similar phenomenon in Gaalpu. Why I treat the boundary as a word boundary will be explained in section 7.2.

16. Very occasionally, a consonant cluster may not coincide with a rhythmic boundary. This happens only when some two-syllable words of form (C)VCCV are articulated quickly. Also, the cluster must be either a nasal-voiced stop sequence, or a lateral-voiced stop sequence. Examples: ['gande?] *'thing'*, ['ildje?] *'you*(pl.)*'*, ['indji?] 'reciprocal marker', ['winde?] *'antbed'*.

17. This will be further reinforced when we consider the distribution of inter-vocalic gemination of voiceless stops, and the distribution of glottal stop.

18. Only a few words appear to be counter examples to the 'up to three syllables' constraint. For example: /bilawili/ [bí'lawile?] *'two'*. These will be handled in section 7.1.

19. The greater acoustic energy of an /a/ vowel can produce a phonetically prominent syllable medially or finally in a stress group; or it may even attract the primary stress into a non-initial position in the stress group. This will be dealt with later in the paper. The specification of **one** stress per stress group refers to **phonetic** stress.

20. Stress group boundaries are assigned on wholly phonological grounds, and therefore are independent of '+' boundaries. For example: /walmini/ *'crossed over'*, has the structure #walmi+ni#, but the phonetic realisation of it is ['wal.mine?].

21. Throughout this paper, I refer to gemination of voiceless stops, only when it is clearly heard phonetically. There is no interpretation involved. A voiceless stop without audible gemination, even though it may be quite fortis, is assumed to be ungeminated.

22. Detailed discussions of the various rules will be reserved for sections 6. and 7.

23. Three-syllable stress groups likewise have mostly sonorant consonants as onsets of the second and third syllables.

24. It is always greater than secondary stress, but can be made exceedingly fortis if the speaker wishes.

25. The specification of [+voice] prevents shifting of the stress across a voiceless stop.

26. Actually, gemination of voiceless stops can be accomplished on the first pass through the rules simply by ensuring that segmentation into stress groups and placement of secondary stress precede the gemination rule. Rule order will also be discussed in sections 6. and 8.

27. If a word to which /iři/ is attached has a word final /l/, then the transition consonant is still [d]. For example: /yili iři/ ['yi:l.diřeʔ] *'later I'*.

28. The rules I propose will assign prominence to strings, and later rules will manifest the prominence in various ways, one of which is by stress.

29. I am assuming that all boundary symbols (including ʔ, ⟍, and .) include the feature [-segment], which is the approach of Chomsky and Halle (1968:365).

30. Henceforth I will use DA to refer to 'durative aspect'.

31. Strictly speaking, I am using the features [1 stress] and [2 stress] in two different ways. These features really represent two degrees of prominence in the rules which assign prominence and shift prominence. Later, when the vowel modification and glottal stop placement rules are being applied, prominence is being assigned its 'surface' phonetic realisations. Thus, after these rules have applied any remaining [1 stress] or [2 stress] features refer to phonetic stress, rather than to prominence. I could have used a feature 'prominence' and employed rules to convert it into stress in the appropriate environments. However nothing substantial is gained by so doing.

32. The conventions for application of rules across boundaries are given by Chomsky and Halle (1968:371). In this paper, the hierarchy I have assumed is ⟍, #, ʔ, ., +. The same authors also discuss the use of 'phonological phrase' boundaries (1968:372). For the latter, I am using '⟍', but I have nothing to say about how to properly insert it

into the string. I have simply assumed that it can be done (see my comments at the beginning of section 6.1.).

33. In section 3.2. I stated that the features used in this paper would not handle vowel neutralisation to schwa. I have decided to get around this problem in an *ad hoc* way, by positing a feature 'schwa'. Hence [ə] will be [+syll, -back, -low, -high, +schwa], while all other syllabics will be [-schwa].

34. Long vowels in closed syllables are quite rare. Clear examples are limited to words of form #CVC#. For example: ['r̲o:m] *'way of life, law'*; ['we:r̃] *'nothing'*; ['yo:l] *'man'*; ['dja:l] *'want'*; and ['me:l] *'eye'*. Hence this rule produces length only in primary stressed open syllables.

35. Orthographically they would of course be only one word.

BIBLIOGRAPHY

CHOMSKY, N. and M. HALLE

1968 *The sound pattern of English.* New York: Harper and Row.

DIXON, R.M.W.

1977 'Some phonological rules in Yidin^{y}'. *Linguistic Inquiry* 8/1:1-34.

GLASGOW, D. and K. GLASGOW

1967 'The phonemes of Burera'. *PL,* A-10:1-14.

HYMAN, L.M.

1975 *Phonology: theory and analysis.* New York: Holt, Rinehart and Winston.

LOWE, B.

1960 Grammar lessons in Gupapuyngu. Methodist Church in Northern Australia (now Uniting Church). Duplicated.

McKAY, G.R.

1975 Rembarnga: a language of central Arnhem Land. Ph.D. thesis, Australian National University.

1977 Medial stop gemination in two central Arnhem Land languages. Paper presented at Bilingual Education Conference, 24 October 1977, Darwin.

VOEGELIN, C.F. and F.M. VOEGELIN

1977 *Classification and index of the world's languages.* New York: Elsevier.

WATERS, B.

1979 'A proposed distinctive feature narrow: evidence from Djinang and Iwaidja'. *WP of SIL-AAB*. Series A, Vol.4, Darwin.

1980 'Djinang verb morphology'. (Pp.141-178 in this volume.)

WOOD, R.H.

1978 'Some Yuulngu phonological patterns'. *PL*, A-51:53-117.

APPENDIX
Swadesh 100 Word List

/mapal/	['map̚.pál]	*'hair, leaf, feather'*
/gun̲gi/	['gon̲.geʔ]	*'head'*
/djabir̲i/	['djabir̲e]	*'mouth'*
/ŋuȓi/	['ŋoȓeʔ]	*'nose'*
/mil/	['me:l]	*'eye, seed'*
/gur̲aki/	[gu'r̲ak̚.keʔ]	*'nape of neck'*
/mani/	['ma:neʔ]	*'front of neck, throat, river'*
/budjiȓi/	['bo:djiȓeʔ]	*'stomach'*
/giliŋkal̲/	['giliŋ.kál̲]	*'skin'*
/malk/	['malk̚]	*'skin'*
/bundiȓi/	['bon.diȓeʔ]	*'knee'*
/yul/	['yo:l]	*'man, person'*
/miyilk/	['miyilk̚]	*'woman'*
/wur̲gi/	['wor̲.geʔ]	*'bird'*
/butjiy/	['bot͡j.tjíy]	*'dog'*
/d̲iȓadjili/	[d̲i'ra.djileʔ]	*'he bites, eats, drinks'*
/ñini/	['ñine]	*'he sits'*
/dji-tjaȓi/	[djiʔ'tjaȓeʔ]	*'he stands'* (durative)
/ŋuȓidji/	['ŋoȓi.djiʔ]	*'he lies (recline)'*
/gir̲i/	['gir̲eʔ] ∿ ['kir̲eʔ]	*'he walks'*
/gadjigaȓ/	['gadji.gáȓ]	*'path (road)'*
/r̲iȓkiyañ/	['r̲iȓ.kiyǽñ]	*'stone'*
/wana/	['wan̄aʔ]	*'big'*
/ninin/	['ni:nin]	*'small'*
/djuŋgi/	['djoŋ.geʔ]	*'fire, wood, tree'*
/ŋawiȓk/	['ŋa:wiȓk̚]	*'smoke'*
/gibilbal/	['gibil.bál]	*'ashes'*
/butjir̲i/	['bot͡j.tjir̲eʔ]	*'ear, horn'*
/djilaŋ/	['djilaŋ]	*'tongue'*

/ḏir̃pal/	['ḏir̃.pál]	*'tooth'*
/biṟi/	['beṟe?]	*'breast, chest'*
/gumbir̃i/	['gom.bir̃e?]	*'hand, claw'*
/nu/	['no:]	*'foot, root'*
/walir̃/	['walir̃]	*'sun'*
/djar̃ibiṟ/	['djar̃i.biṟ]	*'afternoon sun'*
/ṟangu/	['ṟan.go?]	*'moon'*
/kaṯa/	['kat̆.ta?]	*'star'*
/guḏitjimar̃/	['goḏi.tjimár̃]	*'star'*
/ginimbir̃i/	['ginim.bir̃e?]	*'cloud'*
/mayur̃k/	['mayur̃k̆]	*'rain'*
/djur̃umuk/	['djur̃u.múk̆]	*'rain'*
/gapi/	['gap̆.pe?]	*'water'*
/mundjal/	['mon.djál]	*'flesh'*
/maypal/	['may.pál]	*'meat'*
/guḻtji/	['guḻ.tje?]	*'fat'*
/giyi/	['geȳe?]	*'egg'*
/ir̃iñ guŋili/	['er̃iñ.'goŋile?]	*'he gives it to me'*
/ñaŋiṉi/	['ñaŋiṉe?]	*'he sees'*
/bi kiṟimi/	[bi'kiṟi.me?]	*'he comes'*
/mimi/	['mem̄e?]	*'louse'*
/wuṟpmi/	['wuṟp̆.me?]	*'one'*
/bingili/	['beń.gile?]	*'two'*
/ḏuṟkḏuṟk/	['ḏuṟk̆.'ḏuṟk̆]	*'heart'*
/miḏimiḏi/	['miḏi.'miḏi]	*'liver'*
/ŋiṟki/	['ŋiṟ.ke?]	*'bone'*
/buḏi/	['boḏe?]	*'blood'*
/miman/	['mem̄an]	*'tail'*
/yaṟṯi/	['yaṟ.ṯe?]	*'tail'*
/yagir̃i/	['yagir̃e?]	*'name'*
/guyi/	['goȳe?]	*'fish'*
/munatja/	['muna.tja?]	*'sand, earth'*
/bukiḻ/	['bok̆.kíḻ]	*'mountain'*
/bambuli/	['bam.bóle] ∿ ['bam.bole?]	*'bark'*
/wur̃ki/	['wur̃.ke?]	*'seed, flower'*
/maliṟi/	['maliṟe?]	*'night'*
/baṟdjiniŋ/	['baṟ.djíniŋ]	*'white'*
/mul/	['mo:l]	*'black'*
/butjalak/	['bot̆j.tjalák̆]	*'yellow'*
/miki/	['mek̆.ke?]	*'red'*
/buṯal/	['bot̆.ṯál]	*'good'*

/gil̲iwil̲iŋ/	['gil̲i.wil̲íŋ]	*'long'*
/min̲/	['min̲]	*'cold'*
/mur̲mur̲ñir̲iŋ/	['mur̲.'mur̲t̲̆.ñír̲iŋ]	*'warm, hot'*
	(the [t̲̆] is a transition segment only)	
/yiwir̲idjiŋ/	['yowir̲i.djíŋ]	*'new'*
/galbi/	['gal.biʔ]	*'many'*
/wařapam/	['wařa.pám]	*'all'*
/djiniŋ/	['djiniŋ]	*'this'*
/djinim/	['djinim]	*'this (not near to hand)'*
/ŋunuŋ/	['ŋunuŋ]	*'that'*
/ŋunum/	['ŋunum]	*'that (over there)'*
/war̲i/	['war̲eʔ]	*'who?'*
/wit̲ñir̲iŋ/	['wit̲.ñír̲iŋ]	*'round'*
/buřdjiŋ/	['buř.djíŋ]	*'dry'*
/dulpi/	['dol.peʔ]	*'full, sated'*
/gutum/	['gut̆.túm]	*'full, sated'*
/iŋki/	['iŋ.kiʔ]	*'not, no'*
/wiř/	['weř] ∿ ['we:ř]	*'none, no'*
/ñani waŋini/	['ñani.'waŋineʔ]	*'he says'*
/mařiŋini/	['mači.ŋineʔ]	*'he hears'*
/mar̲aŋgi/	['mar̲aŋ.giʔ]	*'he knows'*
/yakiřidjin/	['yak̆.kíři.djín]	*'he sleeps'*
/ŋuřiñin/	['ŋoři.ñín]	*'he sleeps'*
/bumi/	['bomeʔ]	*'kill, make'*
/balini/	['balineʔ]	*'he dies'*
/buřdjiři/	['buř.djiřeʔ]	*'it burns (fire)'*
/nundjiřali/	['nun.djiřále]	*'it flies, it runs'*
/yigilim/	['yigilím]	*'he swims'*
/ŋaři/	['ŋařeʔ]	*'I'*
/ñuni/	['ñoneʔ]	*'you'*

THE DISTRIBUTION OF PHONEMES IN AUSTRALIAN ABORIGINAL LANGUAGES

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INTRODUCTION

The aim of this paper is to present an analysis of the phonological systems of Australian aboriginal languages. For such an analysis it is necessary to examine the types of phonemes that constitute a phonological system and the contrasting characteristics of the systemic arrangements.

The approach adopted looks at the types of position of articulation arrangements within manner of articulation classes. Of all the possible combinations that are permutable in each class of sounds it is found that only a small number are ever realised. For example, the stop arrangement of /b d ḍ g/ is never found, for the only 4-stop position arrangement occurring in Australian languages is /b d d^y g/.

The areal distributions of these distributional systems can also be examined, and it should be noted that areal congruence is as equally important as areal diversity, for both can suggest diachronic development and synchronic relations. Appendix 1 contains the areal distributions that correspond to the systemic arrangements, with Map 1 indicating the approximate positions of the languages studied.

Busby, P.A. "The Distribution of Phonemes in Australian Aboriginal Languages". In Waters, B. and Busby, P. editors, *Papers in Australian Linguistics No. 14*.
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1.0. CONSONANT PHONEMES

Table 1 is a listing of the consonants that have been recorded in the languages studied; the horizontal arrangement of positions of articulation reflects the preferred emphasis on the active articulator rather than the passive place of articulation (Dixon 1980:20). The vertical arrangement of manners of articulation represents the order of the analysis in the following sections.

TABLE 1: CONSONANT PHONEMES

	Apical		Laminal		Peripheral			
	Alveolar	Retroflex	Dental	Palatal	Bilabial	Velar	Palato-velar	Glottal
stops	d	ḍ	ḏ	d^{y}	b	g	gj	ʔ
2nd series stops	t	ṭ	ṯ	t^{y}	p	k		
Prenasalised stops	nd	ṇḍ	n̠d̠	n^{y}d^{y}	mb	ŋg	ŋjgj	
nasals	n	ṇ	ṉ	n^{y}	m	ŋ	ŋj	
laterals	l	ḷ	ḻ	l^{y}				
Prestopped nasals	N	Ṇ	N̠	N^{y}	M	Ŋ		
Prestopped laterals	L	Ḷ	L̠	L^{y}				
Prepalatalised	^{y}d/^{y}n ^{y}N/^{y}l							
Rhotic release stops	d^{r}	ḍ^{r}						
prenasals	nd^{r}							
Labialised stops	d^{w}	ḍ^{w}			b^{w}	g^{w}		
prenasals	nd^{w}			n^{y}d^{yw}	mb^{w}	ŋg^{w}		
prestopped nasals					M^{w}	Ŋ^{w}		
laterals		ḷ^{w}						
Rhotics flap	r							
trill	ř							
Glided rhotics	ɹ	R						
Glides			y̠	y	w/ẅ			
Fricatives	s/z		ð	ʒ	β	ɣ		

The tabular representation given is also indicative of the sound represented by the symbol employed with the following exceptions. The choice of the voiced symbols for the stop series and the voiceless for the second series stops does not necessarily represent the true nature of the distinction in any language. It is a device that reflects a marking phenomenon in Australian linguistics, for it is normal practice for single stop series languages to be represented by either set of symbols; some researchers prefer the voiced, others the voiceless. The voiced symbols are used throughout this analysis for languages with no contrast, voiceless symbols for when a contrast is present. In language names the presence of the voiceless symbol does not necessarily indicate the occurrence of a second stop series, but is rather the preference of the researcher concerned or an idiosyncrasy of mine. Some modifications to language names have been made for ease of orthographic representation.

The use of capital letters to represent phonemes is restricted to prestopping and rhotics, and is an orthographic device representing this phenomenon, discussed in 1.7. and 1.11. below.

It could be argued that those sounds represented by two symbols, like prenasalised stops, prepalatals and labialised consonants could perhaps be better treated as clusters. However, for the purpose of systematic analysis, author preference has been overlooked. Take for example, prenasalised stops. Burera has initial homorganic nasal and stop clusters which are treated as such (Glasgow and Glasgow 1962:10); Alawa is recorded as having prenasalised stops (Sharpe 1972:14). I have treated both languages in the same manner and record them as having prenasalised stops. However, in those languages where a researcher has not marked initial clusters as prenasalised stops I will indicate these by placing the word 'initial' in brackets after the language name.

Note that a question mark in brackets after a language name indicates uncertainty on the part of the researcher or myself. Also, the number and percentage figures that occur after each arrangement indicates the number of languages having this set of phonemes. The percentage is the proportion this group occupies out of the total number of languages sampled.

1.1. *STOP CONSONANTS*

We shall exclude the glottal stop from this section (see 1.2. below) and examine the arrangement patterns of the seven remaining stops. The following five arrangements are found, the distributions are set out below:

b d d^y g

b d ḍ d^y g

b d d̪ d^y g

b d ḍ d̪ d^y g

b d ḍ (d̪) d^y gj g

1.1.1. b d d^y g (21 = 15.65%)

Guugu-Yalanji	Mabuiag	Lenngidigh
Gidabal	Mulurudji	Lama-lama
Gureng-gureng	Malag-malag	Waka-waka
Djaabugay	Ngarigu	Warungu
Dyirbal	Ngengomeri	Wargamay
Tiwi	Nganjaywana	Waalubal
Maranunggu	Nyangumarda	Yidiny

It should be noted that in the single laminal languages, namely 1.1.1. and 1.1.2., some authors prefer to use the dental symbol rather than the palatal. The reason appears to rest in the allophonic alternation of the two. In Tiwi, for example, /d^y/ is found preceding /i/, /d̪/ elsewhere (Osborne 1974:10). Obviously the dental occurs in more environments than the palatal and thus the preferred symbol is the dental. The other languages that have this preference for the dental symbol are Mabuiag, Lama-lama, Lenngidigh, and in 1.1.2., Madi-madi. Preference is given to uniformity and the laminal palatal symbol is used in languages with no laminal contrast. This type of phenomenon supports the diachronic evidence on the development of two laminals from one (Dixon 1970b:92).

The areal distribution of the 4-stop arrangement is found on Map 2, Appendix 1. This type occurs along the east coastal regions of Australia, Cape York and the Daly River region of the Northern Territory. Only one example, Nyangumarda, is found in Western Australia. It appears that the central region is devoid of this type. It should be noted that the areal distribution covers only those languages studied. Therefore the claim of non-appearance is not absolute, but rather a suggestion of the distribution pattern of a certain phenomenon. This caveat applies throughout the study.

1.1.2. b d ḍ d^y g (29 = 21.64%)

Andagerinja	Bard	Gugada
Alawa	Pitjantjatjara	Djaru
Burera	Gugandji	Djeebana
Pungu-pungu	Garadjari	Mayali

Pintupi	Gunwinggu	Mantjiltjara
Madi-madi	NjungaR	Waḍaman
Mara	Rembarnga	Walmatjari
Maung	Wadyiginy	Waramunga
Ngarinjin	Walpiri	Wambaya
Ngarla	Yiwadja	

The double apical, single laminal languages are restricted to the western half of the continent. On Map 3 we see that Madi-madi is the only language that occurs east of the eastern Northern Territory-South Australian border.

1.1.3. b d d̲ d^y g (33 = 24.63%)

Aridingidigh	Kuku-Thaypan	Ngangikurrungurr
Awngdim	Guugu-Yimidhirr	Ngiyamba
Umbila	Thaayore	Ndraˀangid
Umbuygamu	Dhurga	Ludigh
Brinken	Dharawal	Wikmunkan
Gugu-Badhun	Mbabaram	Wik-Ep
Kunjen	Mbeiwum	Wikmumin
Kurtjar	Mbalidjan	Yir-Yoront
Gog-Nar	Mpakwithi	Yathaikana
Koko-Bera	Mbara	Yinwum
Kuuku-Yaˀu	Nggod	Yuwaalaraay

In Guugu-Yimidhirr John Haviland (personal communication) reports the possibility of retroflex stops and nasals for he found the regular occurrence of initial retroflexes in a few cases. Initial occurrence is quite significant for it is in this position that the retroflex and alveolar distinction can be neutralised, as in the case of some Mara words for example (Busby 1978:3-4).

On Map 5 we find the areal distribution of the double laminal, single apical languages. They are predominantly restricted to the Cape York region, with two cases in the Daly River area: Brinken and Ngangikurrungurr. These are the only two examples west of the eastern north-south Northern Territory-South Australian borders.

1.1.4. b d ḍ d̲ d^y g (47 = 35.07%)

Andiljaugwa	Kitja	Nunggubuyu
Andegeribina	Djamindjung	Lardil
Alyawarra	Djabu	Ritharngu
Arabana	Djambarrpuynggu	Warramiri

Aranda	Thargari	Wangurri
Bidyara	Dalabon	Wagilak
Pita-pita	Datiway	Wanggumara
Bailko	Diyari	Wangganguru
Kaititj	Malyangapa	Waḷuwara
Gubabuyngu	Murawari	Wemba-wemba
Kukatj	Mandelbingu	Yinytyiparnti
Galpu	Margany	Yanhangu
Gungabula	Murinbata	Yandruwandha
Kuthant	Ngawun	Yukulta
Kalkatungu	Ngaḷuma	Yaraldi
Kurama	Nanta	

Note that Dalabon may not have the dental series. O'Grady, Voegelin and Voegelin (1966:61) are uncertain of its status, whilst Capell (1962: 93) lists them as phonemic. The distribution of this 6-stop arrangement, Map 4, is rather scattered, with only Cape York and the east coast being exempt. Gungabula and Bidyara in central Queensland and Murawari on the Queensland border are the most eastern occurrences, Yaraldi and Wemba-wemba are the most southern.

1.1.5. b d ḍ (d̲) d^y gj g (4 = 2.99%)

Djingili	Garawa
Ngarndji	Yanyula

Of these four languages only Yanyula has the full seven stops, the other three lack the dental. We can see on Map 6 that these languages are restricted to a small area west of the southern end of the Gulf of Carpentaria. Djingili and Ngarndji are in the Djingili-Wambayan language family, whilst Yanyula and Garawa do not appear to be related despite their geographical closeness. Of all four, only Yanyula is a prefixing language (Wurm 1972:118-119). It is interesting to note that Gudandji, occurring between the two groups, is a double apical, single laminal language. Wambaya has the same system as Gudandji and occurs south of Djingili.

1.2. *GLOTTAL STOP*

Capell remarked that the glottal stop is found "almost exclusively in Cape York Peninsula and Arnhem Land" (Capell 1967:91); with the exception of Nanta in Western Australia, this statement holds true. In the Arnhem Land languages the glottal stop may be considered a syllable prosody (Dixon, personal communication), although only a few researchers have recorded it as such. In only Gunwinggu (Carroll 1976:15) and Rembarnga (McKay 1975b:14) we find this aspect mentioned.

1.2.1. Arnhem Land Languages

Gunwinggu	Djambarrpuyngu	Warramiri
Galpu	Djabu	Wangurri
Gubabuyngu	Mandelbingu	Wagilak
Datiway	Ritharngu	Yanhangu
Dalabon	Rembarnga	

1.2.2. Other Languages

Awngdim	Murinbata	Lenngididigh
Umbuygamu	Maung	Lama-lama
Umbila	Nggod	Wikmunkan
Kuuku-Yaʔu	Ndraʔangid	Wik-Ep
Thaayore	Nanta (?)	Yinwum
Mpakwithi	Ludigh	Yir-Yoront
Mayali		

The glottal stop occurs in only one word in Murinbata; /muʔmun/ *'water rat'* (Walsh 1976:25). Map 7 shows the areal distribution where we see that the only exception to Capell's observation is Nanta on the West Australian coast. It is of importance to note that the source of the Nanta material was O'Grady, Voegelin and Voegelin (1966:61) and not the result of an in-depth study. Their material varies in quality. In Aranda, for instance, there is agreement with other researchers, whilst in others, like Brinken there are differences. Tryon recorded no retroflexes, no dental except the stop, no vowel length and the possible occurrence of schwa (Tryon 1974:71) in Brinken in comparison to the phonemic system given by O'Grady, Voegelin and Voegelin. In this instance I have used Tryon's material.

1.3. *SECOND SERIES STOPS*

In the analysis of languages under study there has been a natural division in double stop phonologies. The first of these was in Arnhem Land, the second was a more geographical diverse group. The same type of division can be found with glottal stop occurrences (see 1.2. above).

For those languages with a specification following, the label indicates the choice of the researcher.

1.3.1. Arnhem Land Languages

These languages appear to have a distinction only in certain environments and under some morphophonemic constraints. In Mayali, the distinction is found intervocalically and after some sonorants (Merlan, personal communication); in Galpu the situation seems to be similar (Wood 1977:28).

Burera	Mayali (lenis/fortis)
Gubabuyngu (gem./non-gem.)	Ngangikurrungurr
Galpu	Rembarnga (gem./non-gem.)
Djambarrpuynggu	Ritharngu (lenis/fortis)
Djabu	Wangurri
Djeebana (gem./non-gem.)	Warramiri
Datiway	Wagilak
Mandelbingu	Yanhangu

Burera is included even though Glasgow and Glasgow (1962) dismiss the second series. Tryon reported them and states that their behaviour is similar to others in this group (Tryon 1974:231). Ngangikurrungurr is reported as having a double stop system on one hand (Courtenay 1976: n.p.), whilst on the other they have been dismissed for morphophonemic reasons (Tryon 1974:231). Tryon also remarked that the same phenomenon occurs in some of his Daly River languages, and these perhaps should be included in this language group. The predictability, however, of the second series of stops is still unclear in some of the languages within this Arnhem Land group.

1.3.2. Other Languages

Umbuygamu (voiced/voiceless)	Djamindjung (voiced/voiceless)
Kunjen (aspirate/non-aspirate)	Thargari (voiced/voiceless)
Diyari (voiced/voiceless)	Wikmumin (voiced/voiceless)
Murinbata (voiced/voiceless)	Wanggumara (voiced/voiceless)
Margany (tense/lax)	Waramunga (gem./non-gem.)
Mbeiwum (voiced/voiceless)	Waḷuwara (voiced/voiceless)
Mabuiag (voiced/voiceless)	Yandruwandha (voiced/voiceless)

In Diyari only two voiced stop phonemes occur, namely the apicals /d/ and /ḍ/ (Austin 1978a:51). In the case of Djamindjung and Murinbata the situation is similar to Ngangikurrungurr in that these two languages lack the dentals /d̲/ and /n̲/. Because of this peculiarity, Walsh sets up /t̠/ as a marginal phoneme in both cases (Walsh 1976:24 and personal communication). In Waramunga, Hale (1959c:1) reports that $\begin{matrix}C\\ [+stop]\end{matrix} \rightarrow [+gem] \ / \ \begin{matrix}V\\ [+stress]\end{matrix}$ ——. However, we do find geminate nasals and laterals in his fieldnotes. It has also been reported that "all consonants except semi-vowels and the flap can be geminated" (Chakravarti 1976:7); thus the phonemic status of this phenomenon is unclear.

Finally, the occurrence of voiceless and voiced stops in Waḷuwara is in complementary distribution with vowel length (Breen 1971:24). For example, we find /pantu/ *'waist'* and /pa:ndu/ *'butt of tree'* (Dixon personal communication). I have followed Breen's analysis and specified the distinction as voiced/voiceless as opposed to vowel length.

It will be noticed that the five methods of distinction: (voiced/voiceless), (aspirate/non-aspirate), (tense/lax), (fortis/lenis) and (geminate/non-geminate) are not mutually exclusive. In Galpu, for instance, the distinction was reported to be fortis, voiceless, geminate/lenis, voiced, non-geminate (Wood 1977:28). The areal distribution of the second stop series is found on Map 8.

1.4. *PRENASALISED STOPS*

As well as the previous comments on prenasalisation above (1.0.), I wish to make the further point that I am not making the claim that in Australian languages the syllable structure is such that in any word the initial consonant position will be filled by a unit phoneme alone. The use of the term prenasalised stop to describe initial clusters of a homorganic nasal and stop is a device to register similarity, thus recording the extent of initial clusters and prenasalised stops.

The occurrence of the word 'initial' in brackets indicates the recording of initial clusters which have not been described as prenasalised stops.

- Alyawarra (?)
- Alawa
- Aridingidigh (initial)
- Andegeribina
- Burera (initial)
- Kalkatungu (initial)
- Kaititj (?)
- Kuku-Thaypan
- Mbabaram (initial)
- Mbara
- Mara
- Mpakwithi
- Mbeiwum (initial)
- Mbalidjan
- Ndraʔangid (initial)
- Nggod (initial)
- Lama-lama
- Yanyula (initial)
- Yinwum

Both Alyawarra and Kaititj are included in this section because prenasalised stops do occur at the phonetic level. Their analysis at the phonemic level is, however, another problem (Koch, personal communication). In Kalkatungu there is only the recording of three initial clusters, namely /mb/, /nd/ and /ŋg/ (Blake 1969:7). It should be noted that Jagst sets up a series of prenasalised stops in Walpiri because of one instance of initial /mb/ (Jagst 1975:21). However on the basis of other data (Dixon, personal communication) and because it is only one instance, a series of prenasalised stops shall not be included.

Map 9 shows the areal diversity of prenasalised stops. We find that Cape York has a large percentage and these languages are known as being some of the Initial Dropping Languages (Sutton 1976:102-124). These languages have the diachronic development of for instance, /bamba/ > /mba/ and thus we find synchronically, the initial homorganic nasal and stop cluster (Dixon 1980:4). Eastern Arnhem Land and Central Australia are the other areas where prenasalised stops are present.

1.5. *NASALS*

> The most powerful generalization opposed by not a single exception, is that the number of linear distinctions made among oral stops in a given language is identical with the number of linear distinctions made among nasals.
>
> (O'Grady, Voegelin and Voegelin 1966:57)

This complements Ferguson's universal claim that no language has more nasal positions than stop positions (Ferguson 1966:57).

Such a statement is fairly representative of the number of nasals in the majority of Australian languages. There are, however, a small group of languages which do not have a one-to-one correspondence of nasal and stop positions. The first type is found in Djingili and Ngarndji (C11 and 12 on Map 10) where the palato-velar nasal /ŋj/ is not present. It is interesting to note that the other two languages with the equivalent stop arrangement, Garawa and Yanyula, have the corresponding nasal.

The second type of unequal correspondence involves the laminal nasal. In double laminal stop languages the dental nasal is either subphonemic or absent. This is the case in the languages:

Djamindjung	Wemba-wenba
Murinbata	Awngdim (?)
Ngangikurrungurr	Brinken
	Gugu-Badhun

As mentioned previously (1.3.2.), Djamindjung and the following three languages also lack the voiced dental stop whilst the voiceless /t̪/ is present. In Gugu-Badhun the distinction between the laminal stops is phonemic, in nasals it is phonetic. Note that /n/ → [nʸ] / —— /i/,

[n] elsewhere (Sutton 1973:78). This is the same environment for the laminal stop alternation in Tiwi (see 1.1.1. above).

In the single laminal stop languages we find only two cases where the laminal nasal is absent, Mabuiag and Lama-lama in Cape York. Map 10 shows that the languages where the number of stops is greater than the number of nasals are restricted to Cape York and Arnhem Land; Wemba-wemba on the Murray River is the only exception.

It is important to note that all languages have the same number of apical stops as apical nasals. Peripheral stops and nasals are also in a one-to-one correspondence excepting the palato-velar nasal as specified above. It is in the laminals that we find the cases where the number of nasals and stops can be unequal.

1.6. *LATERALS*

Two points are worth noting in the discussion of the following position arrangements of laterals found in Australian languages. The first is directed at the type of analysis employed. Lateral position arrangements are discussed in terms of symmetry, where a one-to-one correspondence of laterals with non-peripheral stops is a symmetrical system. The non-symmetrical systems are listed according to stop arrangements. This gives us two sets of figures, discussed in 1.6.6. below.

The second point concerns the types of systems that do not occur. We do not find that the number of laterals is greater than the number of non-peripheral stops in any language. We also find that all languages with two laminal laterals also have two apical laterals. The single laminal lateral, single apical lateral type (1.6.2.) is small in number, suggesting that the laminal laterals are more phonologically complex. In nasals we saw that it was the laminal, or the laminal dental in double laminal stop languages, that may be subphonemic or absent. We may therefore suggest that laminals, especially the dental place of articulation, is more complex in the sense of an implied hierarchy of phonological complexity.

1.6.1. l (51 = 38.06%)

Symmetrical: Ø

Non-symmetrical:

Stop type 1 (b d d^y g)

Gugu-Yalanji	Tiwi	Wargamay
Gidabal	Mulurudji	Warungu
Gureng-gureng	Mabuiag	Waalubal

Djaabugay	Maranunggu	Waka-waka
Dyirbal	Lenngidigh	Yidiny
	Lama-lama	

Stop Type 2 (b d ḍ d^y g)

Djeebana

Stop Type 3 (b d ḏ d^y g)

Awngdim	Kuku-Thaypan	Ngiyamba
Aridingidigh	Thaayore	Ndraˀangid
Umbila	Dhurga	Ludigh
Guugu-Yimidhirr	Dharawal	Wikmumin
Gugu-Badhun	Mbara	Wik-Ep
Koko-Bera	Mpakwithi	Wikmunkan
Kunjen	Mbalidjan	Yathaikana
Kurtjar	Mbeiwum	Yinwum
Gog-Nar	Mbabaram	Yuwaalaraay
Kuuku-Yaˀu	Ngangikurrungurr	Nggod

Stop Type 4 (b d ḍ ḏ d^y g)

Bidyara	Lardil
Gungabula	Wemba-wemba

On Map 11 we see the areal distribution of the single lateral languages restricted to Cape York and the east coast of Australia. The most inland languages are Wemba-wemba and Yuwaalaraay. In Arnhem Land we find the four languages Tiwi, Ngangikurrungurr, Maranunggu and Djeebana.

1.6.2. l l^y (9 = 6.72%)

This surprisingly is quite rare, occurring in only the following nine languages:

Symmetrical:

Stop Type 1 (b d d^y g)

Malag-malag	Nganjaywana	Ngarigu
Ngengomeri		Nyangumarda

Non-symmetrical:

Stop Type 2 (b d ḍ d^y g)

Yiwadja

Stop Type 3 (b d ḏ d^y g)

Umbuygamu	Brinken	Yir-Yoront

There appears to be no areal congruence of this system. Map 12 shows us Nganjaywana in the east for instance and the Daly River languages in the north-west of Arnhem Land.

1.6.3. l ḷ l^y (30 = 22.39%)

Symmetrical:

Stop Type 2 (b d ḍ d^y g)

Alawa	Bard	Garadjari
Andagerinja	Pintupi	Gugada
Pitjantjatjara	Gugandji	Djaru
Madi-madi	Ngarinjin	Waramunga
Maung	Ngarla	Walmatjari
Mantjiltjara	NjungaR	Waḍaman
Mayali	Wambaya	Walpiri

Non-symmetrical:

Stop Type 4 (b d ḍ ḏ d^y g)

Kitja	Murinbata	Malyangapa
Djamindjung	Margany	Nunggubuyu

Stop Type 5 (b d ḍ (ḏ) d^y gj g)

Garawa	Djingili	Ngarndji

Areally, we find that there are two cases east of the eastern Northern Territory-South Australian north-south border (Map 13). They are Margany and Madi-madi; the rest of the languages in this lateral arrangement are scattered over the western three-quarters of the continent.

1.6.4. l ḷ (26 = 19.14%)

Symmetrical: Ø

Non-symmetrical:

Stop Type 2 (b d ḍ d^y g)

Pungu-pungu	Gunwinggu	Rembarnga
Burera	Mara	Wadyiginy

Stop Type 4 (b d ḍ ḏ d^y g)

Gubabuyngu	Kurama	Datiway
Galpu	Djabu	Dalabon
Kukatj	Djambarrpuyngu	Mandelbingu
Kuthant	Thargari	Murawari
Ngawun	Wangurri	Yinytyiparnti
Ritharngu	Warramiri	Yanhangu
Wagilak		Yukulta

Murawari may have the laminal palatal lateral, the status however, is uncertain (Oates 1976:244). On Map 14 we notice that there is a concentration of languages in eastern Arnhem Land, in the western area the Daly River languages Pungu-pungu and Wadyiginy. In Western Australia we find a few cases, but none are found in the central region of the continent. To the south of the Gulf of Carpentaria we find a few languages, the most inland being Ngawun. The most eastern case appears to be Murawari on the Queensland-New South Wales border.

1.6.5. l ḷ ḻ l^y (18 = 13.43%)

Symmetrical:

Stop Type 4 (b d ḍ ḏ d^y g)

Andegeribina	Pita-pita	Nanta
Aranda	Kalkatungu	Waḷuwara
Alyawarra	Kaititj	Wanggumara
Arabana	Diyari	Wangganguru
Andiljaugwa	Ngaḷuma	Yaraldi
Bailko		Yandruwandha

Stop Type 5 (b d ḍ (ḏ) d^y gj g)

Yanyula

Non-symmetrical: Ø

Map 15 shows that the 4-lateral type is found predominantly in central Australia. Yaraldi on the mouth of the Murray River is the most southern language. Yanyula and Andiljaugwa in Arnhem Land and a few cases in Western Australia are the only other cases outside this central region.

1.6.6. **Stop and Lateral Distributions**

Table 2 shows the percentages of membership to each combination. The zero components (those shown as Ø) are predictable in most cases for there cannot be a lateral which has no corresponding stop phoneme. Therefore type 1 stop system cannot occur with types 3-5 lateral systems. A type 3 stop system is a single apical and is thus excluded from lateral system types 3-5. Type 5 stop system includes only four languages so we would expect gaps in its lateral series membership. However we find the null set for type 4 stop system and type 2 lateral system. In other words, we find no instances of the stop and lateral combination of:

b	d	ḍ	ḏ	d^y	g
	l			l^y	

TABLE 2: PERCENTAGES OF STOP AND LATERAL DISTRIBUTIONS

2.1. Lateral group by % of $\frac{\Sigma \text{ in each stop group}}{\text{Total } \Sigma \text{ of stops in each lateral group}}$

stop group

lateral group	1	2	3	4	5	Σ
1	31.37	1.96	58.83	7.84	ø	100.00
2	55.56	11.11	33.33	ø	ø	100.00
3	ø	70.00	ø	20.00	10.00	100.00
4	ø	23.08	ø	76.92	ø	100.00
5	ø	ø	ø	94.44	5.56	100.00

2.2. Lateral group by % of $\frac{\Sigma \text{ of each stop type in lateral group}}{\text{Total } \Sigma \text{ of stops in each stop group}}$

lateral group

stop group	1	2	3	4	5	Σ
1	76.19	23.81	ø	ø	ø	100.00
2	3.45	3.45	72.41	20.69	ø	100.00
3	90.91	9.09	ø	ø	ø	100.00
4	8.51	ø	12.77	42.55	36.17	100.00
5	ø	ø	75.00	ø	25.00	100.00

It is worth noting the following more common combinations from both tables:

stop type 3 and lateral type 1   b d d̲ dʸ g
l

stop type 4 and lateral type 4   b d ḍ d̲ dʸ g
l ḷ

stop type 1 and lateral type 2   b d dʸ g
l lʸ

stop type 2 and lateral type 3   b d ḍ dʸ g
l ḷ lʸ

On the other hand, unlikely combinations are as equally relevant, for example:

stop type 2 and lateral type 1	b	d	ḍ	dʸ	g	
		l				

stop type 4 and lateral type 1	b	d	ḍ	d̪	dʸ	g
		l				

stop type 4 and lateral type 3	b	d	ḍ	d̪	dʸ	g
		l	ḷ		lʸ	

1.7. *PRESTOPPING*

This section concerns prestopped nasals and laterals. It is felt that in terms of distribution, it is better to regard this phenomenon as prestopping rather than "stops with nasal release" (O'Grady, Voegelin and Voegelin 1966:59) and laterally released stops. Phonotactically, prestopped nasals for instance have the same distribution as nasals in Kaititj (Koch, personal communication), and sometimes alternate with long nasals in both Kaititj and Alyawarra (Yallop 1977:12).

Prestopped nasals occur in the following languages:

Aranda	Arabana	Kaititj
Alyawarra	Kunjen	Wangganguru

Arabana and Wangganguru lack the retroflex and velar prestopped nasal, the other languages have six except Kunjen with five, for the retroflex is absent in this case.

Prestopped laterals are found in Yandruwandha, Arabana and Wangganguru. Again, the last two do not have a full set of four, the retroflex is absent.

It should be noted that the number of prestopped nasals does not exceed the number of nasals and likewise for laterals. Excepting Kunjen, all the languages have six nasals and four laterals. Yandruwandha is the only language that has prestopped laterals but no prestopped nasals.

Map 16 shows that Kunjen in western Cape York is the only language distant from the rest in the central region of Australia; otherwise this phenomenon is an areal feature.

1.8. *PREPALATALISATION*

In Andegeribina we find the only case of phonemic prepalatalisation in the data surveyed. This is a device employed to allow for a morphophonemic two vowel system of a/a: (Breen 1977a:384). Andegeribina is found in Central Australia, C6 on Map 16.

1.9. *RHOTIC RELEASE*

The rhotic release of apical stops and the alveolar prestopped nasal appears to be a different phenomenon from the prestopping of certain stops before rhotics. In Mpakwithi for instance, rhotic released stops function phonotactically as stops and not as rhotics (Crowley, personal communication).

/d^r/ is found in:

Awngdim	Ndraˀangid	Yinwum
Aridingidigh	Nggod	Yandruwandha
Mpakwithi	Lenngidigh	

/nd^r/ is found in:

Mpakwithi	Ndraˀangid	Yinwum

/ḍ^r/ is found in:

Yandruwandha

Breen regards the rhotic released stops in Yandruwandha as prestopped trills (Breen 1976c:597), presumably on the basis of phonological similarity with prestopped laterals. However, there is no evidence as to the phonotactic function of the rhotic released stops in Yandruwandha, whether or not they function in the same manner as stops or rhotics. It is thus felt that they are best described as rhotic released stops as opposed to prestopped trills for we notice that /d^r/ occurs elsewhere and functions phonotactically as a stop. It is also somewhat discordant to describe /ḍ^r/ as a retroflex prestropped trill as opposed to a rhotic released retroflex stop.

Areal occurrence of the rhotic released stop is in Cape York, with Yandruwandha in Central Australia the only exception; see Map 17.

1.10. *LABIALISATION*

Labialisation is a phonotactic or prosodic device employed to describe the rounding of certain consonants in a manner similar to the phonological constructions of the preceding three sections. The languages and their respective labialised consonants are:

Andiljaugwa: g^w ŋ^w

Mbabaram (?): g^w (ŋ^w) d^w n^w

Andegeribina: mb^w ŋg^w b^w g^w m^w ŋ^w M^w Ɲ^w

Tiwi: unknown (Breen 1977b)

Alyawarra: b^w d^w ḍ^w g^w ŋ^w ḷ^w (?)

It is important to note that Alyawarra and the other Arandic languages in this study (Aranda and Kaititj) do have phonetic rounding on some consonants, their status being a matter of morphophonemic arrangement (Koch, personal communication). The Alyawarra data above is taken as being phonemic by its researcher (Turtle 1977:6). Yallop, on the other hand, recorded in Alyawarra the following consonants as being the first member of a cluster where the second was /w/: b, d, g, M, Ŋ, m, ŋ, n, mb, nd, n^{y}d^y (Yallop 1977:43).

Geographically, on Map 18 we see the Central Australian languages, Mbabaram in Cape York, Andiljaugwa on Groote Island and Tiwi on Melville and Bathurst Islands.

1.11. *RHOTICS*

In Australian languages four rhotics have been recorded; the flap, trill and two glided rhotics, the retroflex and alveolar. The majority of languages, 80.60%, have two rhotics, the retroflex continuant /R/ and the flap or trill /r/. I prefer to use /R/ and not /ɽ/ (cf. Dixon 1972) for orthographic ease; it does not imply a uvula trill as its IPA value might indicate. IPA /ɹ/ is conventionally not used in describing Australian languages and is reserved here for the alveolar glided rhotic in Murinbata (1.11.5. below). It is of importance to note that /r/ in this case usually has both flap and trill allophones. In those languages where the trill and flap are in phonemic contrast, the flap is marked as /r/ and the trill as /ř/.

In the remaining four types of arrangement we notice that we do not find the flap and trill without the retroflex continuant but do find just a flap or trill without the continuant. We also find only one doubtful case of the continuant rhotic /R/ as the only rhotic present in the phonology of a language. One language contrasts the two glided rhotics with the trill or flap.

1.11.1. R r (continuant, trill/flap) (108 = 80.60%)

Aridingidigh	Bard	Gugada
Awngdim	Pitjantjatjara	Koko-Bera
Andagerinja	Brinken	Gunwinggu
Alawa	Kaititj	Guugu-Yalanji
Andiljaugwa	Galpu	Kitja
Alyawarra	Garadjari	Djamindjung

Aranda
Andegeribina
Arabana
Umbila
Umbuygamu
Burera
Pungu-pungu
Pintupi
Bidyara
Bailko
Mbabaram
Mandelbingu
Maranunggu
Mbara
Mbeiwum
Mantjiltjara
Mayali
Mara
Maung
Mpakwithi
Murawari
Malag-malag
Margany
Ngarndji
Ngarla
Nganjaywana
Ngengomeri
Nggod
Ngiyamba
Mulurudji
Kurama
Gudandji
Kalkatungu
Kunjen
Gungabula
Gugu-Badhun
Gubabuyngu
Guugu-Yimidhirr
Garawa
Kuku-Thaypan
Ngarinjin
Ngawun
Ngangikurrungurr
NyungaR
Nyangumarda
Ndraˀangid
Nanta
Nunggubuyu
Lenngidigh
Lardil
Rembarnga
Ritharngu
Wadyiginy
Wangganguru
Warramiri
Wangurri
Wagilak
Wikmunkan
Waka-waka
Wik-Ep
Djeebana
Dyirbal
Djabu
Djaabugay
Djambarrpuynggu
Djingili
Djaru
Thaayore
Tiwi
Datiway
Waḍaman
Warungu
Waḷuwara
Wemba-wemba
Wargamay
Walmatjari
Waramunga
Wambaya
Wikmumin
Yathaikana
Yanhangu
Yir-Yoront
Yukulta
Yaraldi
Yinwum
Yiwadja
Yanyula
Yidiny
Yinytyiparnti
Yuwaalaraay

Both Murawari (Oates 1976:244) and Yiwadja (O'Grady, Voegelin and Voegelin 1966:62 and Capell 1962:129) may have the three rhotic system of /R r ř/.

1.11.2. r (trill/flap) (11 = 8.21%)

Gureng-gureng
Gidabal
Kuuku-Yaˀu
Dharawal
Dhurga
Madi-madi
Mabuiag
Mbalidjan
Ngarigu
Ludigh
Waalubal

Map 19 shows that the areal distribution of this system is restricted to the east coast of Australia. The most western language appears to be Madi-madi.

1.11.3. R r ř (continuant, flap, trill) (13 = 9.70%)

Pita-pita	Dalabon	Lama-lama
Gog-Nar	Diyari	Walpiri
Kurtjar	Malyangapa	Wanggumara
Kuthant	Ngaḷuma	Yandruwandha
Kukatj		

A fairly widespread areal distribution is found (Map 20) with Lama-lama in Cape York the most eastern language. Otherwise, predominance in the Gulf region and northern South Australia account for most, with Ngaḷuma the most western language in this survey.

1.11.4. R (continuant) (1 = 0.75%)

The single glided rhotic is found in one language, Thargari in Western Australia (see Map 21). It has been recorded that [r] is an allophone of /t/, for Klokeid lists /r/ with the stops in his phonemic arrangement and states: "/r/ has voiced flap and trill allophones which are in free variation in most environments with the voiceless stop allophones, and are in fact more frequently occurring" (Klokeid 1969:3). Austin (personal communication) has suggested that there may be two phonemes /t/ and /r/, but he is unsure of their status.

Due to this being the only example of a language with a retroflex glided rhotic and since the researchers seem to disagree, the status and validity of this rhotic system is in doubt.

1.11.5. r R ɹ (trill/flap, retroflex and alveolar continuants) (1 = 0.75%)

On Map 20 we notice that the only language with this system, Murinbata, is located in the Port Keats region of the Northern Territory. We may be tempted to dismiss this system on the grounds that it occurs in only one language but it should be noted that its occurrence is well documented (Walsh 1976). In fact, even the language name contains the alveolar glided rhotic, "muɹinypata" (Walsh 1976). The neighbouring languages, Djamindjung and Ngangikurrungurr, which share many common features such as stop and nasal distributions, do not have these three rhotics. They have the more frequent system of two rhotics, /R/ and /r/.

1.12. *GLIDES*

Nearly all languages have two glides /w/ and /y/ (129 = 96.27%), with some languages having three.

1.12.1. y y̱ w (2 = 1.49%)

The extra glide is an interdental, occurring in only two languages in Western Australia, Kurama and Yinytyiparnti (Map 22), of which not much detail is available. It has been suggested that the diachronic development of /y̱/ has been: /l̠/ > /ṯ/ and /ṯ/ > /y̱/ (Wordick, personal communication). This glide is apparently produced with the sides of the tongue against the cheek, the tongue is held flat and the tip is under the bottom teeth (Wordick, personal communication).

1.12.2. w ẅ y (3 = 2.24%)

Unrounded /w/, transcribed /ẅ/ (IPA /ɯ̆/) occurs in Kaititj, Wik-Ep and Waluẉara (see Map 22). In Kaititj it has developed from the velar fricative, and in some instances is produced with some friction or allophonically alternates with the velar fricative (Koch, personal communication).

1.13. *FRICATIVES*

Fricatives are found in Arnhem Land, Cape York and Central Australia. Map 23 shows the areal distribution and we note that Thargari in Western Australia is the only language outside this area.

I have attempted to standardise symbols employed by various researchers. There is no need, for instance, to distinguish voiced and voiceless fricatives in any languages except Mabuiag. To use symbols denoting such a difference may be phonetically accurate but phonemically irrelevant. The voiced symbols will be used in the same manner as was employed in the stop analysis (see 1.1.). We find the following types:

1.13.1. ɣ (6 = 21.43% of languages with fricatives, = 4.48% of the total number of languages)

Aranda	Kuthant	Maung (?)
Alyawarra	Tiwi	Yiwadja (?)

1.13.2. ɣ ð β (14 = 50.00% of languages with fricatives, = 10.45% of the total number of languages)

Aridingidigh	Kuku-Thaypan	Ludigh
Awngdim	Mbeiwum	Lenngidigh

Umbuygamu	Mbalidjan	Yinwum
Kunjen	Nggod	Yathaikana
Kurtjar	Ndraʔangid	

1.13.3. ɣ β (1 = 3.57% of languages with fricatives, = 0.75% of the total number of languages)

Gog-Nar

1.13.4. ð (2 = 7.14% of languages with fricatives, = 1.49% of the total number of languages)

Thargari
Mbara (?)

1.13.5. z β (1 = 3.57% of languages with fricatives, = 0.75% of the total number of languages)

Ngengomeri (?)

1.13.6. s z (1 = 3.57% of languages with fricatives, = 0.75% of the total number of languages)

Mabuiag, which is the only language in this survey with a voiced/voiceless distinction in fricatives.

1.13.7. ɣ z β (1 = 3.57% of languages with fricatives, = 0.75% of the total number of languages)

Lama-lama

1.13.8. z ʒ β (1 = 3.57% of languages with fricatives, = 0.75% of the total number of languages)

Ngangikurrungurr

1.13.9. ɣ ʒ ð β (1 = 3.57% of languages with fricatives, = 0.75% of the total number of languages)

Mpakwithi, which has the largest number of fricatives in any one language.

In general, fricatives are uncommon phonemes, found in only 28 languages (20.90%) in this study. The absence or relative scarcity of fricatives is a major Australian areal characteristic.

2.0. VOWEL PHONEMES

TABLE 3: VOWEL PHONEMES

	Front		Central		Back
	-rnd	+rnd	-rnd	+rnd	+rnd
close	i	ü	ɨ	ʉ	u
half-close	e	ö	ə		o
half-open	æ				ɔ
open			a		

Diphthongs: ua, ɨa(:), ui, ai, ia(:)
Nasalised vowels: ĩ, ẽ, æ̃, ã
Length is distinct for the following vowels.
The bracketed forms are of uncertain status

i (ü) (ɨ) (ʉ) u
e (ö) (ə) o
æ a

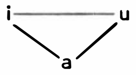
The vowel phonemes of Australian aboriginal languages, found in Table 3, have the same characteristics of the distribution that was found for consonants. Both vowels and consonants in the majority of languages fit into a small set of distributional combinations, with just a small number of aberrant languages. For example, the vowel system /i a u/ is found in 53.73% of all languages, irrespective of a length distinction. We can divide the vowel arrangements into three major types in order to examine their distributions:

2.1. Symmetrical systems, where there is symmetry both in the structure of the vowel diagram and in the presence and absence of a length distinction.

2.2. Semi-symmetrical systems, where there is some form of symmetry or similarity present.

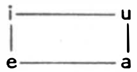
2.3. Ungrouped systems; this being a collection of languages which do not fit into the above two types. It should be noted that vowel systems falling into this group are of the more aberrant types, where one system is usually unique to one language. The exception is the system /i u a a:/ which has three members.

2.1. *SYMMETRICAL SYSTEMS*



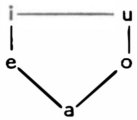
2.1.1.1. i a u

2.1.1.2. i a u (± length)



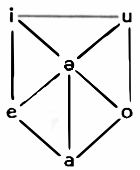
2.1.2.1. i e a u

2.1.2.2. i e a u (± length)



2.1.3.1. i e a o u

2.1.3.2. i e a o u (± length)



2.1.4.1. i e a o u ə

2.1.4.2. i e a o u ə (± length)

2.1.1. i a u

Map 24 shows the distribution of the vowel system /i a u/ without regard for the length distinction. There appears to be no areal congruency.

2.1.1.1. i a u (23 = 17.16%)

Pita-Pita	Dyirbal	Waḷuwara
Bidyara	Tiwi	Wambaya
Garawa	Diyari	Warungu
Gugu-Badhun	Mara	Wanggumara
Kunjen	Ngawun	Yanyula
Gungabula	Nganjaywana	Yaraldi
Guugu-Yalanji	Ngarla	Yandruwandha
Garadjari	Wikmumin	

In Waḷuwara a length distinction is not recorded because of its complementary distribution with the occurrence of a second series of stops (see 1.3.2.).

2.1.1.2. i a u (± length) (49 = 36.75%)

Alyawarra	Djeebana	Ngarigu
Aranda	Djabu	Nyangumarda
Arabana	Djingili	Nanta

Andagerinja	Djambarrpuynggu	Ritharngu
Umbila	Djaabugay	Waramunga
Pitjantjatjara	Thargari	Walmatjari
Bailko	Dharawal	Wargamay
Pintupi	Dhurga	Wagilak
Guugu-Yimidhirr	Datiway	Wangurri
Kuuku-Yaʔu	Murawari	Warramiri
Gubabuyngu	Mulurudji	Wangganguru
Kurama	Mantjiltjara	Walpiri
Kalkatungu	Malyangapa	Yukulta
Gugada	Margany	Yanhangu
Galpu	Mandelbingu	Yidiny
Kukatj	Ngiyamba	Yuwaalaraay
	Ngaḷuma	

Both Bailko and Mulurudji (O'Grady, Voegelin and Voegelin 1966:85 and 67) may not have a length distinction. Similarly, Waramunga (Hale 1959c: n.p.; Chakravarti 1967:6; Capell 1953:298) may not distinguish length at the phonemic level. In Kukatj, a schwa may be present (Breen 1976c:154); whilst in Ritharngu (Heath 1978:34) and Yidiny (Dixon 1977:2-3) length occurs, for the former, on the first syllable only; and for the latter, it is only found on non-initial syllables.

2.1.2. i e a u

Map 25 shows the areal distribution of this system. It appears that there are no cases in Central and Western Australia. We find cases in Cape York and the east coast, Madi-madi in the south and a few instances in western Arnhem Land.

2.1.2.1. i e a u (8 = 5.97%)

Alawa	Madi-madi	Ndraʔangid
Djamindjung	Ngangikurrungurr	Yinwum
Murinbata	Ngengomeri	

In Djamindjung, the status of /e/ is uncertain (Walsh, personal communication).

2.1.2.2. i e a u (± length) (5 = 3.73%)

Gidabal	Lardil	Waalubal
Gureng-gureng		Yathaikana

In the case of Waalubal, Crowley remarks that the length of the vowel /e/ is predictable by rule (Crowley 1978:6-21). However, for symmetry and for areal congruence, an /e:/ is included as part of the phoneme inventory.

2.1.3. i e a o u

Map 26 shows the sporadic occurrences of this vowel arrangement. One example is found in the south-west, NgungaR; but none are found south of the Queensland-New South Wales border.

2.1.3.1. i e a o u (7 = 5.22%)

Burera	Mayali	Waḍaman
Gunwinggu	Ngarinjin	Yiwadja
	NjungaR	

Burera is reported as having word stress like English 'import/im'port (Glasgow and Glasgow 1962:2 and Glasgow 1966:n.p.). This is the only language where stress is reported at the phonemic level.

2.1.3.2. i e a o u (± length) (5 = 3.73%)

Thaayore	Maung	Waka-waka
Mbara		Wikmunkan

2.1.4. i e a o u ə

The six vowel system has a restricted areal distribtuion (Map 27). Cases are found in Cape York and Arnhem Land, with Wemba-wemba being the only language outside this area.

2.1.4.1. i e a o u ə (5 = 3.73%)

Koko-Bera	Rembarnga	Wemba-wemba
Lama-lama		Yir-Yoront

Note that vowel length in Wemba-wemba is possibly predictable by rule (Hercus 1969:28).

2.1.4.2. i e a o u ə (± length) (2 = 1.49%)

Dalabon
Mabuiag

In the case of Mabuiag, vowel length does not occur on schwa (Klokeid 1971:19).

2.2. *SEMI-SYMMETRICAL SYSTEMS*

Map 28 shows the position of the /i a o u/ vowel system: both languages are in Western Australia. The distribution of /i e a u ə/ can be found on Map 29, an area restricted to the Daly River region and only one case in Cape York, Awngdim.

It is of interest to note that there are more cases of /i e a u/ than of /i a o u/; disregarding length and schwa. Nineteen cases are found of the former and only two of the latter in this survey. The following is a list of vowel systems and their language members:

i a u (± length) o (1 = 0.75%)

Bard

i a u (± length) o: (1 = 0.75%)

Yinytyiparnti

i e a u ə (6 = 4.48%)

Awngdim	Pungu-pungu	Maranunggu
Brinken	Malag-malag	Wadyiginy

The status of schwa in Brinken is uncertain (Tryon 1974:71).

i e a u ɨ (1 = 0.75%)

Andiljaugwa

The occurrence of /ɨ/ has only been suggested in one source, namely Dixon (personal communication).

i e a o u ə ö (1 = 0.75%)

Gog-Nar

i æ a u (2 = 1.49%)

Note that it appears that /æ/ is not a notational variant of /e/, for the former is apparently common in Northern Paman languages (Hale 1976a:7-40).

Ludigh

Mbalidjan

i æ a o u (1 = 0.75%)

Lenngidigh

2.3. *UNGROUPED SYSTEMS*

i u a a: (3 = 2.27%)

Ngarndji	Nunggubuyu	Djaru

i ɨ u a a: (1 = 0.75%)

Kitja

i e a o u ɨ ʉ (± length) (?) (1 = 0.75%)

Mbabaram

This language, like Kuku-Thaypan in the next arrangement, can be seen as symmetrical on a vowel diagram.

i e æ a ɔ o u ɨ (?) (1 = 0.75%)

Kuku-Thaypan

i u ʉ æ a (1 = 0.75%)

Aridingidigh

i ü u e o a (1 = 0.75%)

Mbeiwum

i u e ö o æ a (1 = 0.75%)

Nggod

i e a o u ü ö (ɨ) (ʉ) (± length) (?) (1 = 0.75%)

Wik-Ep

i ö u a ɨa ia (± length) ɨ (1 = 0.75%)

Note that diphthongs may be notational variants of Vowel + Glide or Glide + Vowel. However the notations used by the researchers have been followed here.

Kuthant

e ö o a ɨa (± length) (1 = 0.75%)

Kurtjar

i a u ua (1 = 0.75%)

Umbuygamu

i a u ui ai (1 = 0.75%)

Gugandji

2 vowel systems (2 = 1.49%)

Andegeribina a a:

Kaititj ə a

Finally, the largest vowel system, Mpakwithi

i(:)	ĩ	ü	u(:)
e(:)	ẽ	(ö)	o
æ(:)	æ̃		
a(:)	ã		

2.4. *RESIDUE AREAL DISTRIBUTIONS*

2.4.1. Vowel Systems

Map 30 provides us with the occurrence of all languages which have not yet been geographically positioned, excepting the two vowel systems in Kaititj and Andegeribina. They include all of 2.3. and 2.2. except /i e a u ə/ and /i a o u/, the former being found on Map 29, the latter on Map 28. It is of interest to note that these languages are restricted to the northern quarter of the continent, with Cape York having the greatest density.

Map 31 indicates the occurrences of diphthongs, nasalised vowels and the two vowel systems.

2.4.2. Length Distinction

The distinction between long and short vowels is evenly distributed across the whole continent, easily verified by an examination of Maps 32 and 33. Length is found to be distinctive in 73 cases which is 54.48% of the total number of 134 languages in this study.

3.0. CONCLUSION

Certain regularities in the distribution of phonemes are noticeable from this analysis of the phonological systems of Australian aboriginal languages. For instance, every system studied has at least four positions of articulation for stops and nasals, where there is usually a one-to-one correspondence of positions of articulation between these two manners of production. Every language has at least one lateral, one rhotic, although the norm is two, and usually two glides. Vowel systems are dominated by /i a u/, but other systems are not so uncommon.

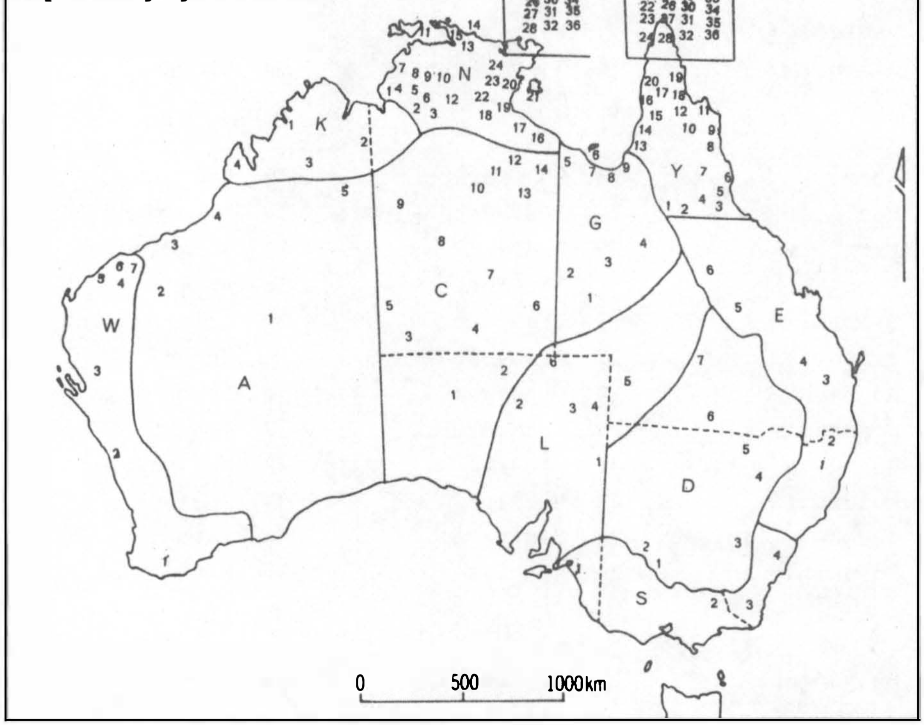
In the analysis of areal distributions it was noticed that the eastern Northern Territory-South Australian north-south border plays an important role in the distributions of the stop system /b d ḍ dʸ g/ (1.1.2.) and the lateral system /l ḷ lʸ/ (1.6.3.). The Cape York region and the east coast of the continent are predominant in the distribution of stop systems 1.1.1. (/b ḍ dʸ g/), 1.1.3. (/b d ḏ dʸ g/); the single lateral system /l/ (1.6.1.); and the occurrence of the single rhotic /r/ (1.11.2.).

Cape York and Arnhem Land are significant areas in a number of distributions. The former has a large concentration of rhotic release stops (1.9.), fricatives (1.13.) and ungrouped vowels (Map 30). The latter is important in the distribution of the second stop series (1.3.), the lateral type /l ḷ/ (1.6.4.); whilst both have a high incidence of the glottal stop.

APPENDIX 1

Areal Distribution of Phonemic Systems

Map 1: Language Positions



Map 1 above gives the approximate locations of the languages studied. I have used the same area coding as the A.I.A.S. Tribal Bibliography. The languages and their respective numbers are as follows. Note that this numbering system is the same throughout the areal distribution maps of Appendix 1.

AREA S

1 Yaraldi
2 Ngarigu
3 Dhurga
4 Dharawal

AREA D

1 Wemba-wemba
2 Madi-madi
3 Ngiyamba
4 Nganjaywana
5 Yuwaalaraay
6 Murawari
7 Margany

AREA E

1 Waalubal
2 Gidabal
3 Waka-waka
4 Gureng-gureng
5 Gungabula
6 Bidyara

AREA Y

1 Mbara
2 Warungu
3 Wargamay
4 Gugu-Badhun
5 Dyirbal
6 Yidiny
7 Mbabaram
8 Djaabugay
9 Guugu-Yalanji
10 Mulurudji
11 Guugu-Yimidhirr
12 Kuku-Thaypan
13 Gog-Nar
14 Koko-Bera
15 Kunjen
16 Yir-Yoront
17 Thaayore
18 Lama-lama
19 Umbuygamu
20 Wikmunkan
21 Wik-Ep
22 Umbila
23 Yinwum
24 Kuuku-Yaʔu
25 Ludigh
26 Wikmumin
27 Ndraʔangid
28 Awngdim
29 Aridingidigh
30 Nggod
31 Lenngidigh
32 Mpakwithi
33 Mbalidjan
34 Mbeiwum
35 Yathaikana
26 Mabuiag

AREA L

1 Malyangapa
2 Arabana
3 Diyari
4 Yandruwandha
5 Wanggumara
6 Wangganguru

AREA K

1 Ngarinjin
2 Kitja
3 Djaru
4 Bard

AREA N

1 Murinbata
2 Djamindjung
3 Waḍaman
4 Ngangikurrungurr
5 Maranunggu
6 Ngengomeri
7 Brinken
8 Wadyiginy
9 Pungu-pungu
10 Malag-malag
11 Tiwi
12 Mayali
13 Gunwinggu
14 Maung
15 Yiwadja
16 Garawa
17 Yanyula
18 Alawa
19 Mara
20 Nunggubuyu
21 Andiljaugwa
22 Dalabon
23 Rembarnga
24 Wagilak
25 Ritharngu
26 Burera
27 Djeebana
28 Yanhangu
29 Djambarrpuyngu
30 Gubabuyngu
31 Wangurri
32 Warramiri
33 Djabu
34 Galpu
35 Datiway
36 Mandelbingu

AREA A

1 Mantjiltjara
2 Bailko
3 Nyangumarda
4 Garadjari
5 Walmatjari

AREA C

1 Gugada
2 Andagerinja
3 Pitjantjatjara
4 Aranda
5 Pintupi
6 Andegeribina
7 Alyawarra
8 Kaititj
9 Walpiri
10 Waramunga
11 Djingili
12 Ngarndji
13 Wambaya
14 Gudandji

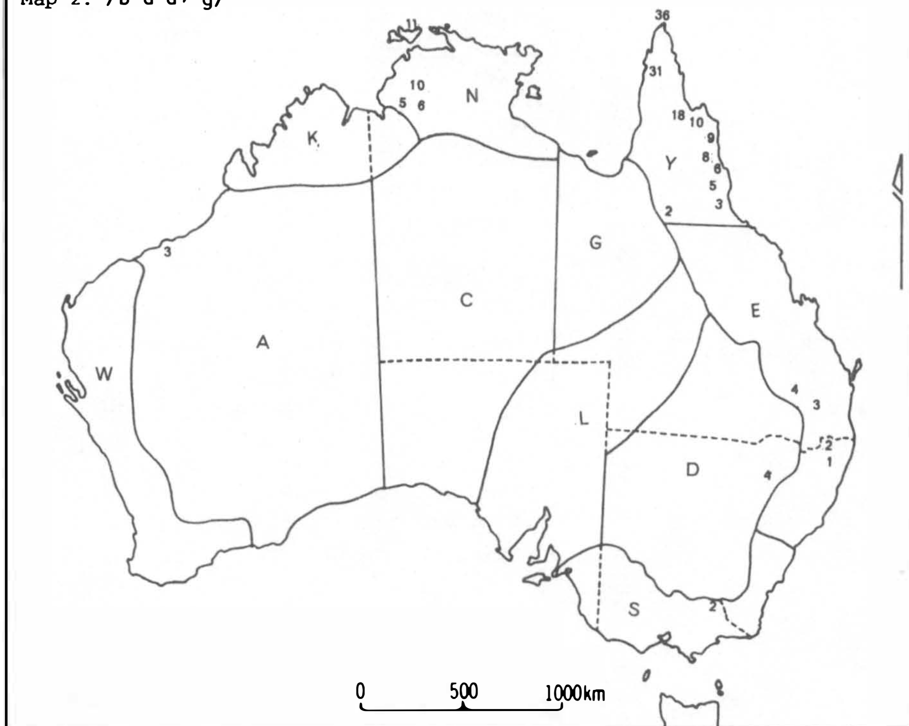
AREA G

1 Pita-pita
2 Waḷuwara
3 Kalkatungu
4 Ngawun
5 Yukulta
6 Lardil
7 Kukatj
8 Kuthant
9 Kurtjar

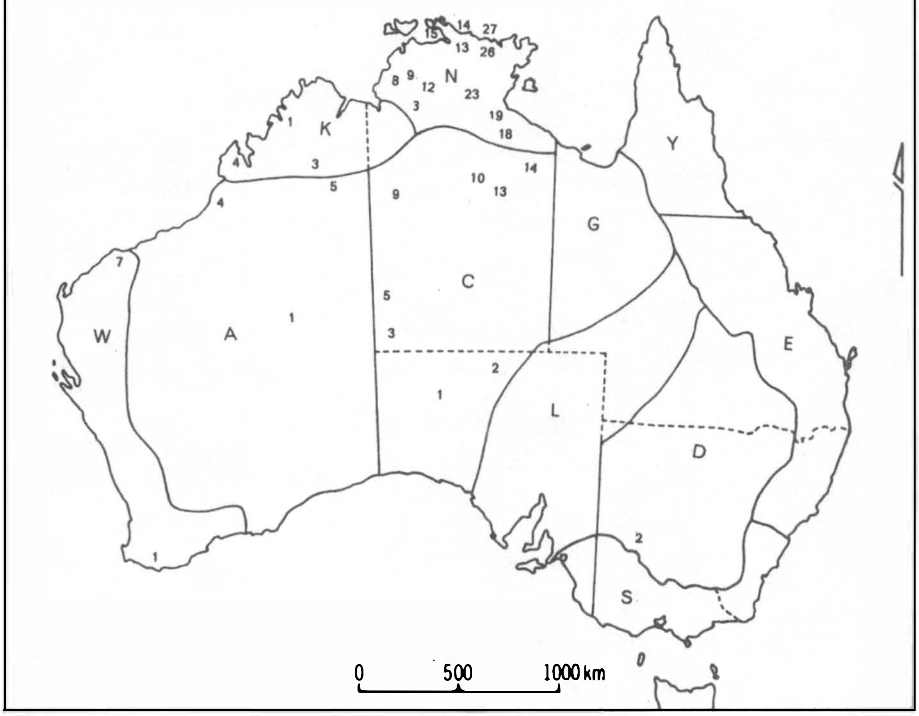
AREA W

1 NjungaR
2 Nanta
3 Thargari
4 Yinytyiparnti
5 Kurama
6 Ngaḷuma
7 Ngarla

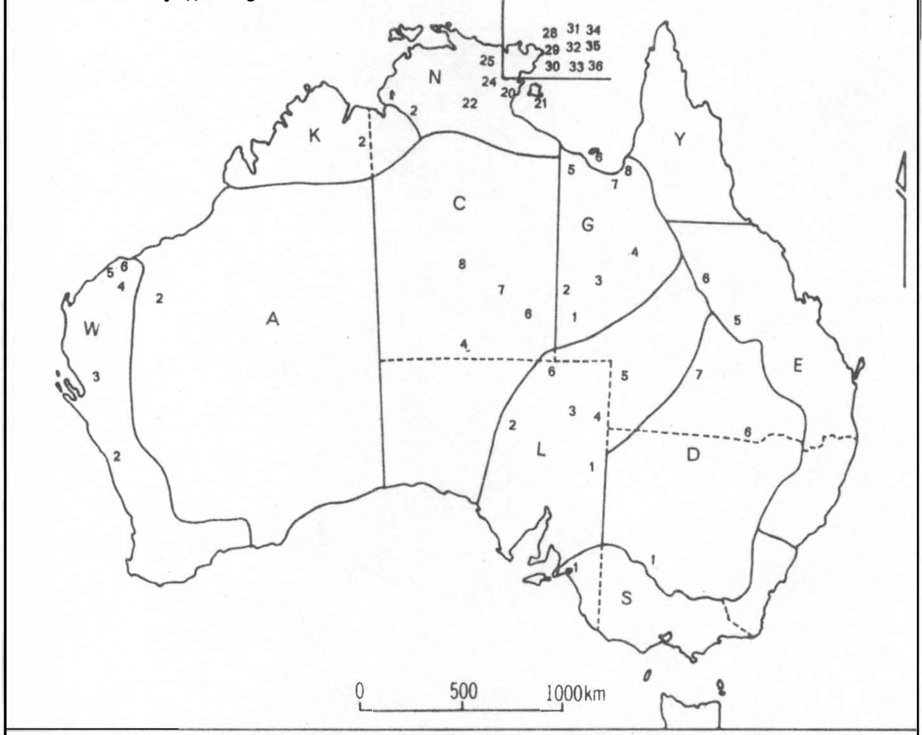
Map 2: /b d dʸ g/



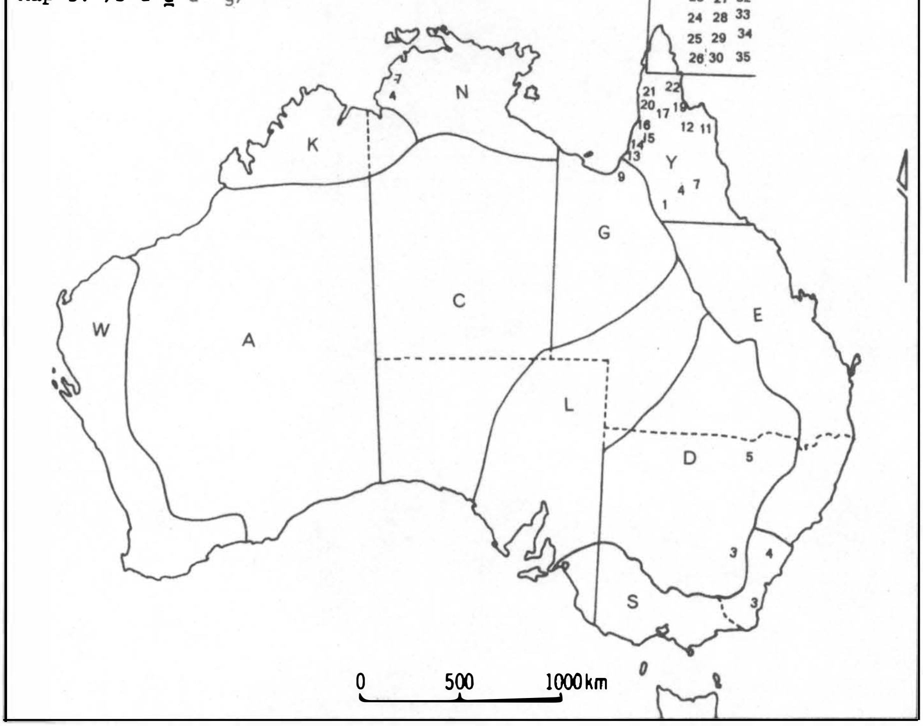
Map 3: /b d ḍ dʸ g/



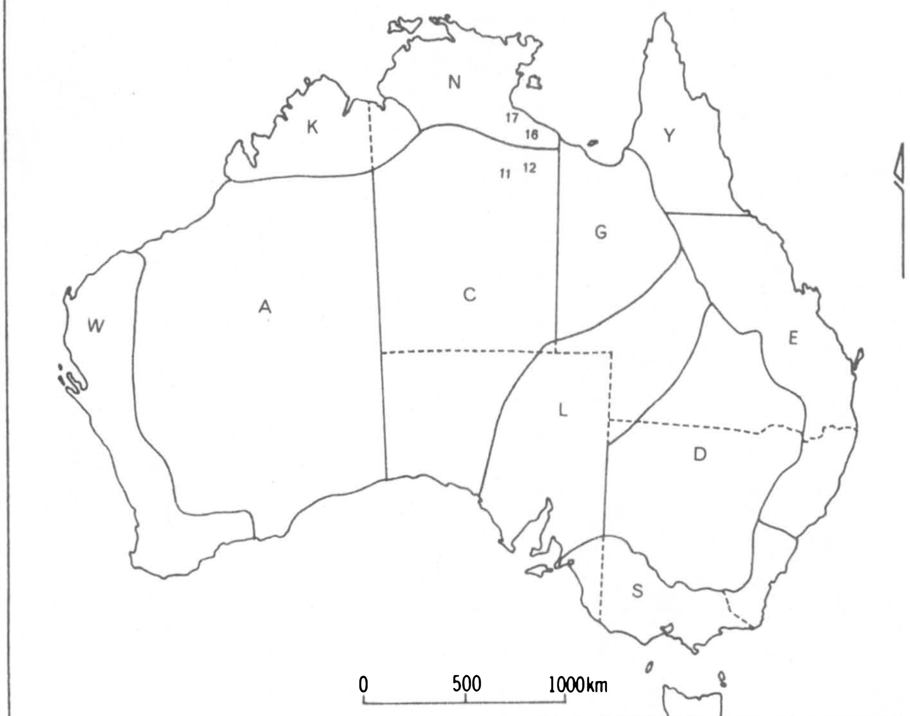
Map 4: /b d ḍ d̲ d^y g/



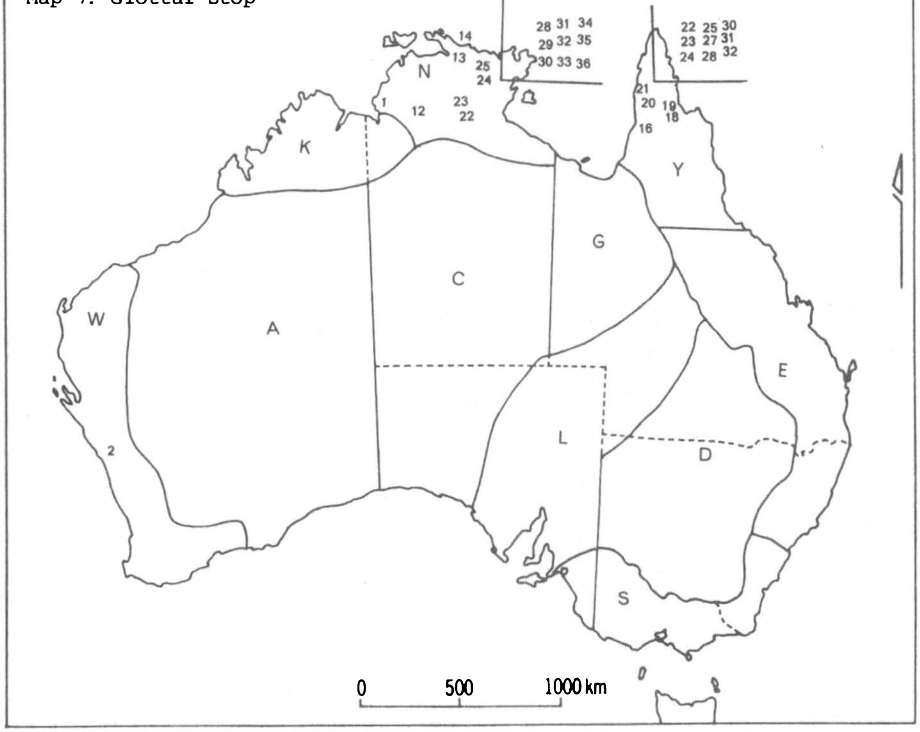
Map 5: /b d d̲ d^y g/



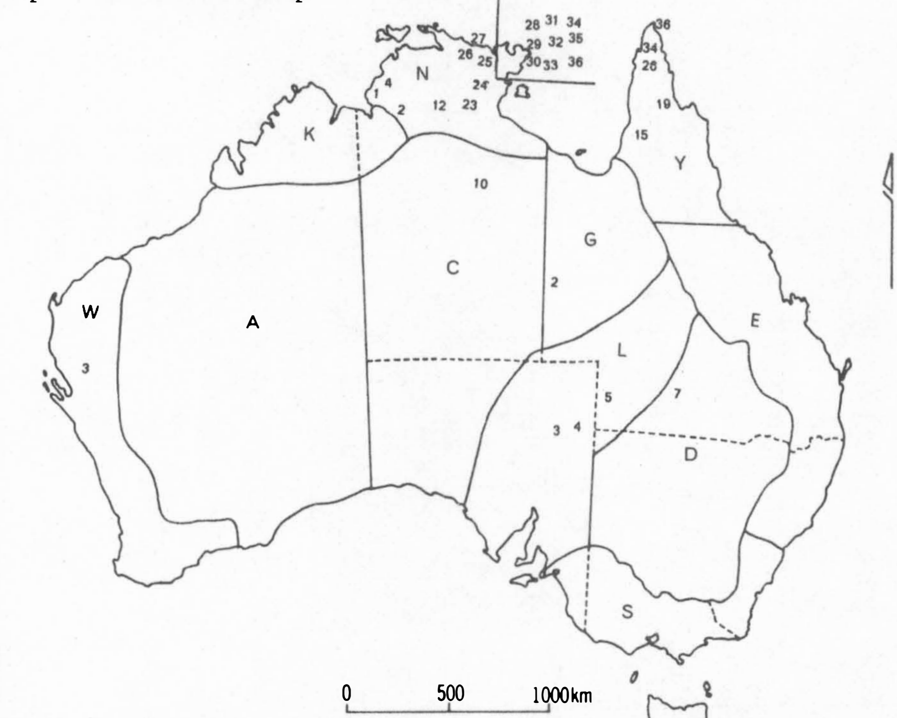
Map 6: /b d ḍ (d̲) d^y gj g/



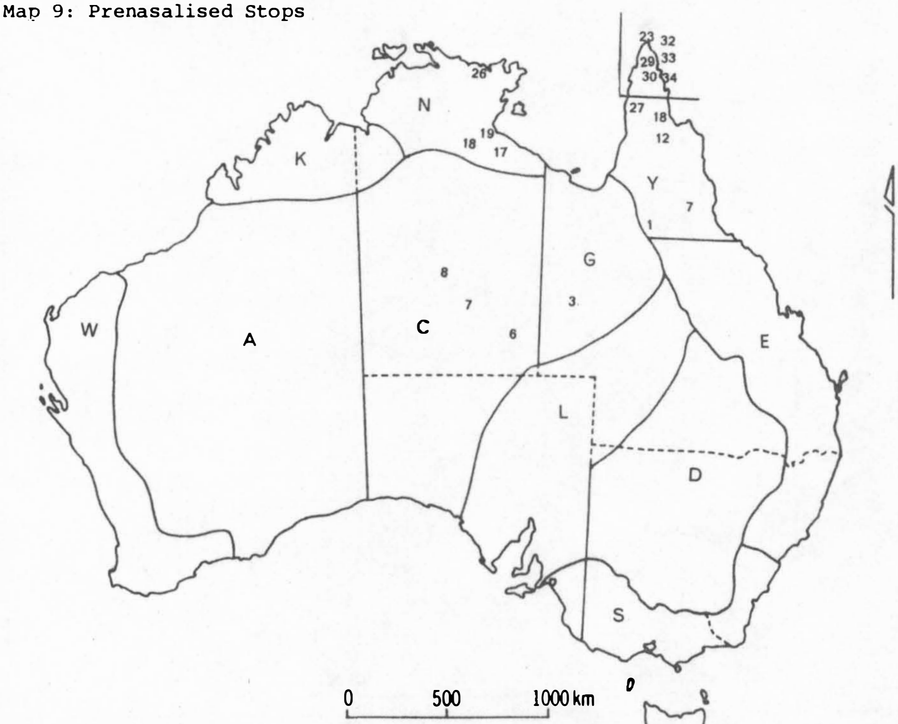
Map 7: Glottal Stop



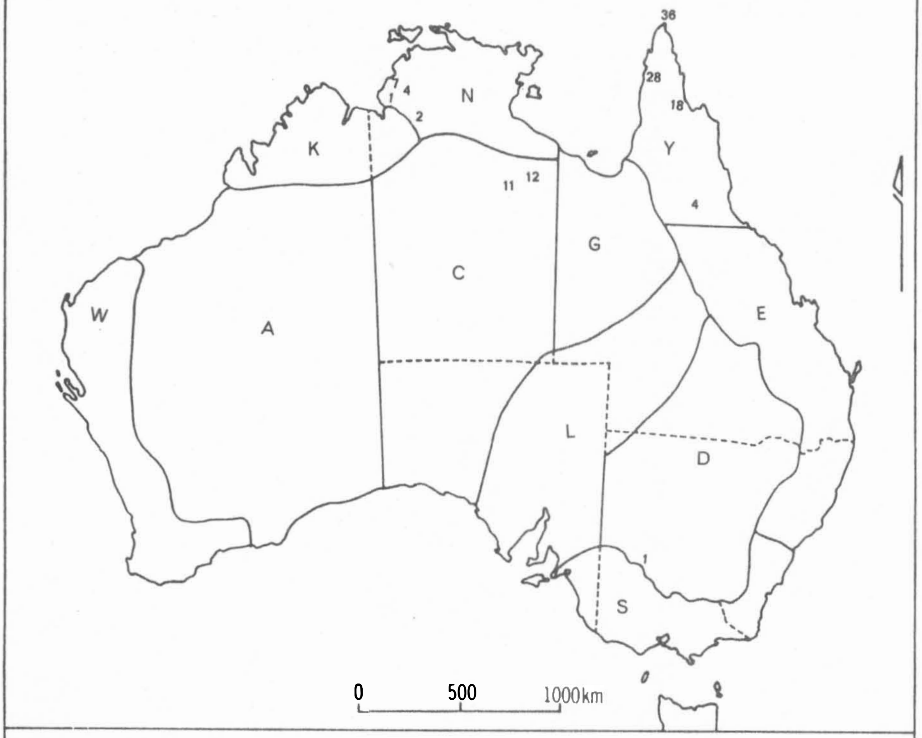
Map 8: Second Series Stops



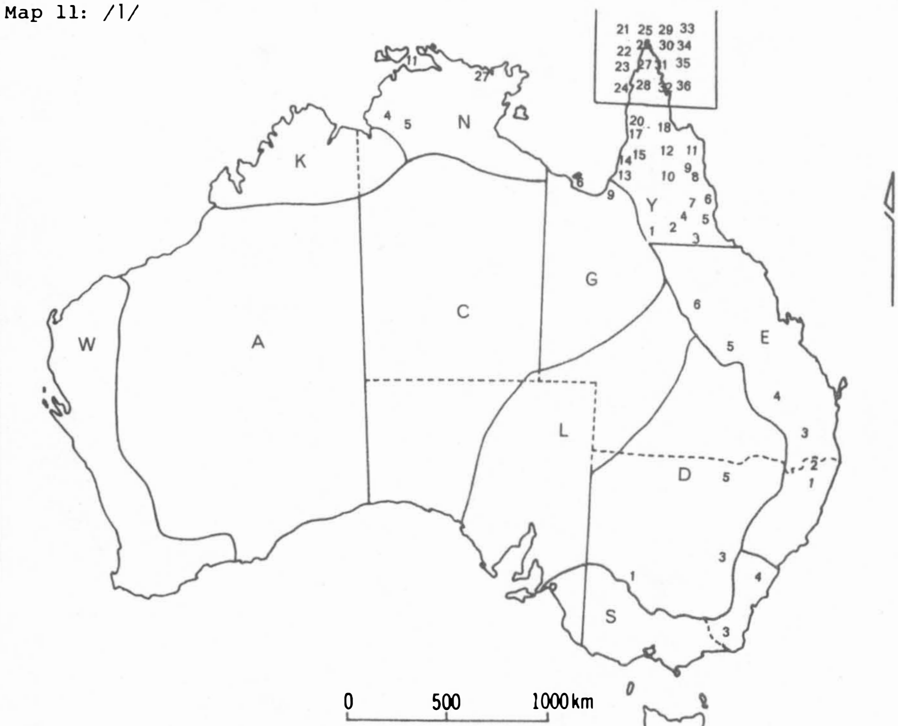
Map 9: Prenasalised Stops

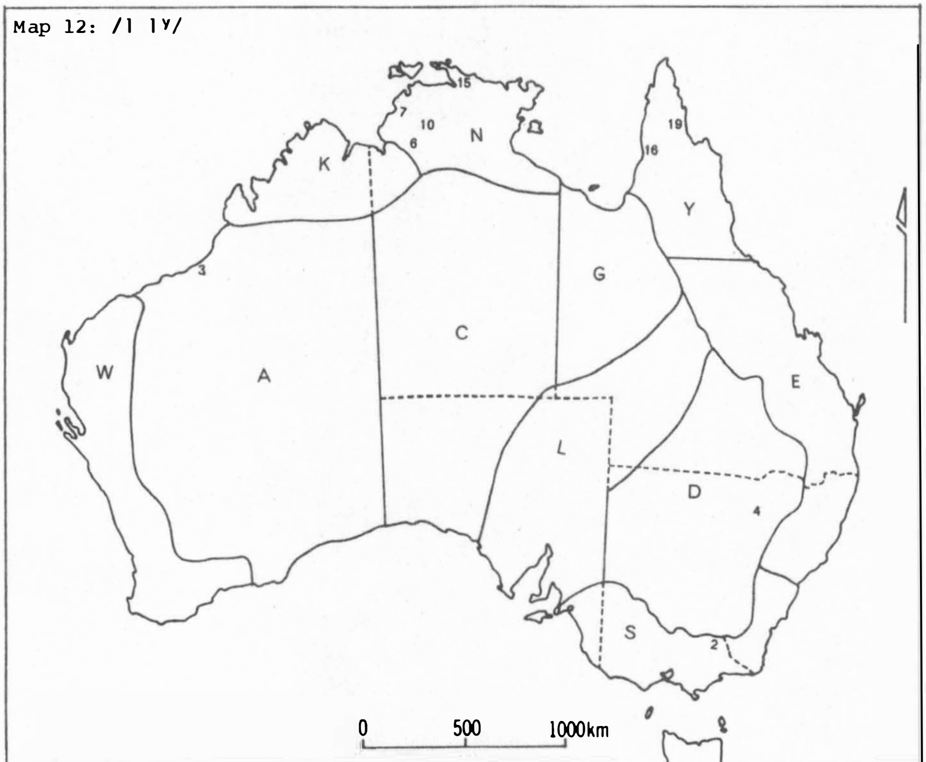


Map 10: Nasals ≠ Stops

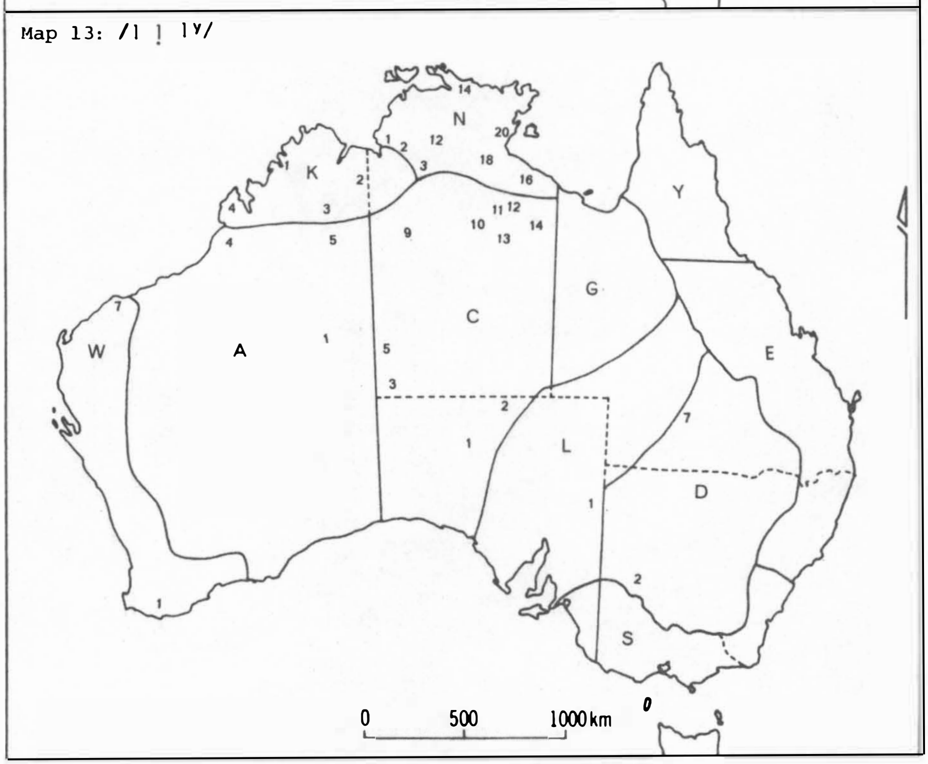


Map 11: /l/



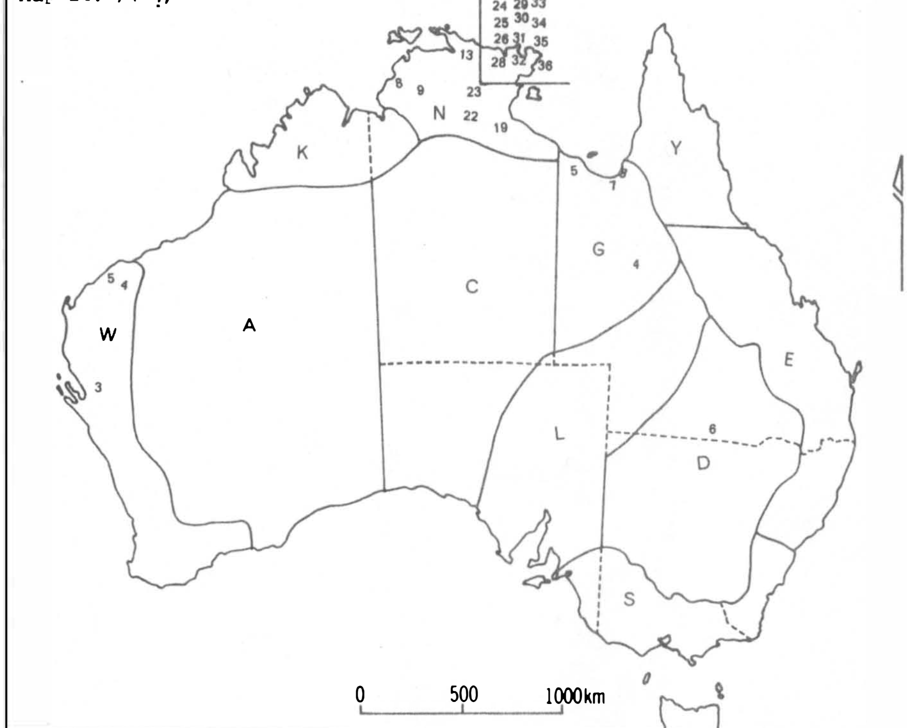


Map 12: /l l^y/

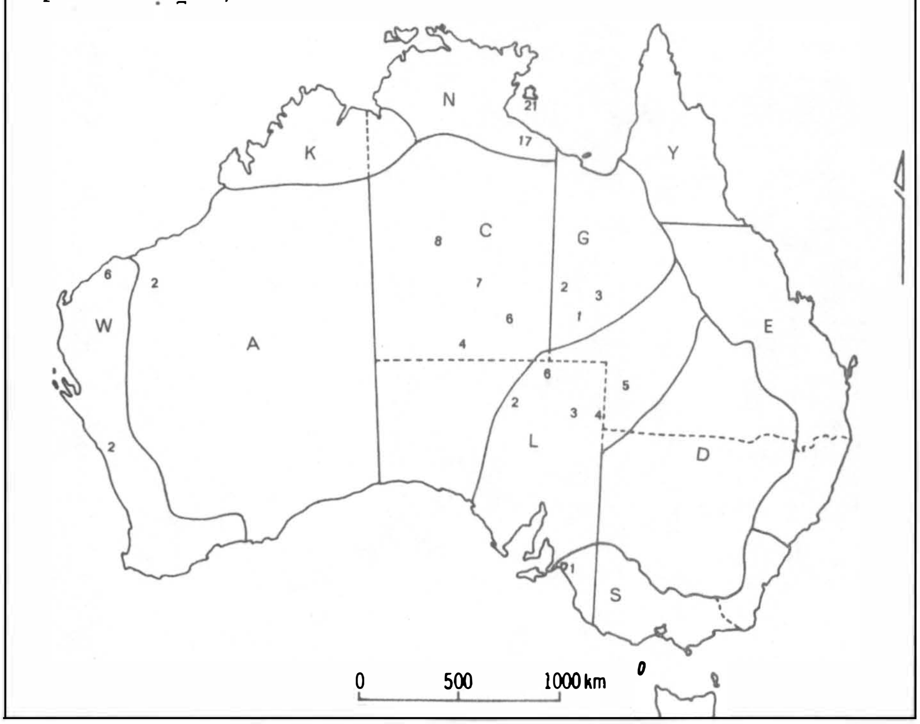


Map 13: /l ḷ l^y/

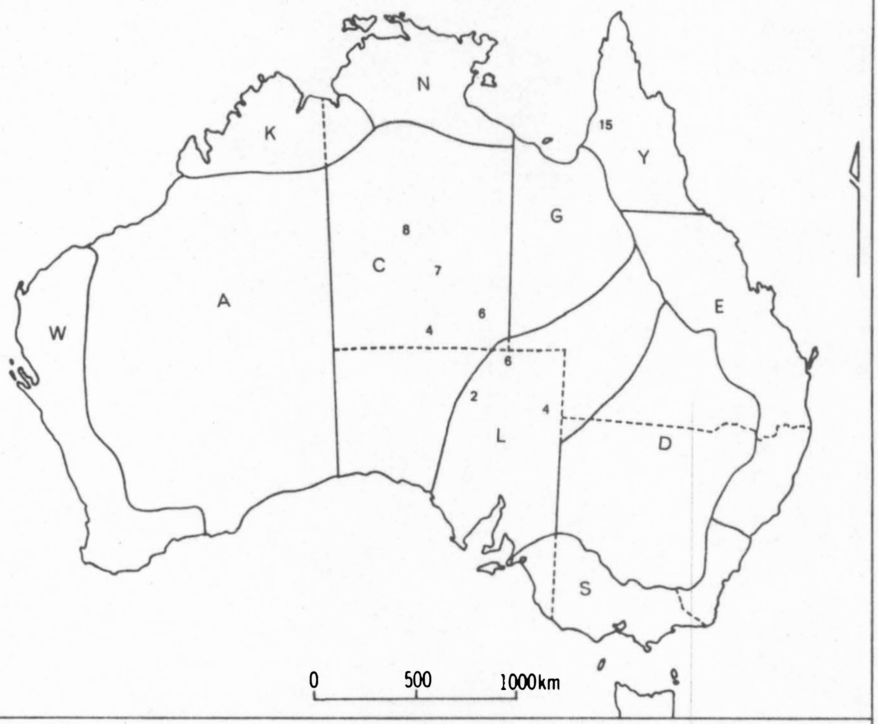
Map 14: /l ḷ/



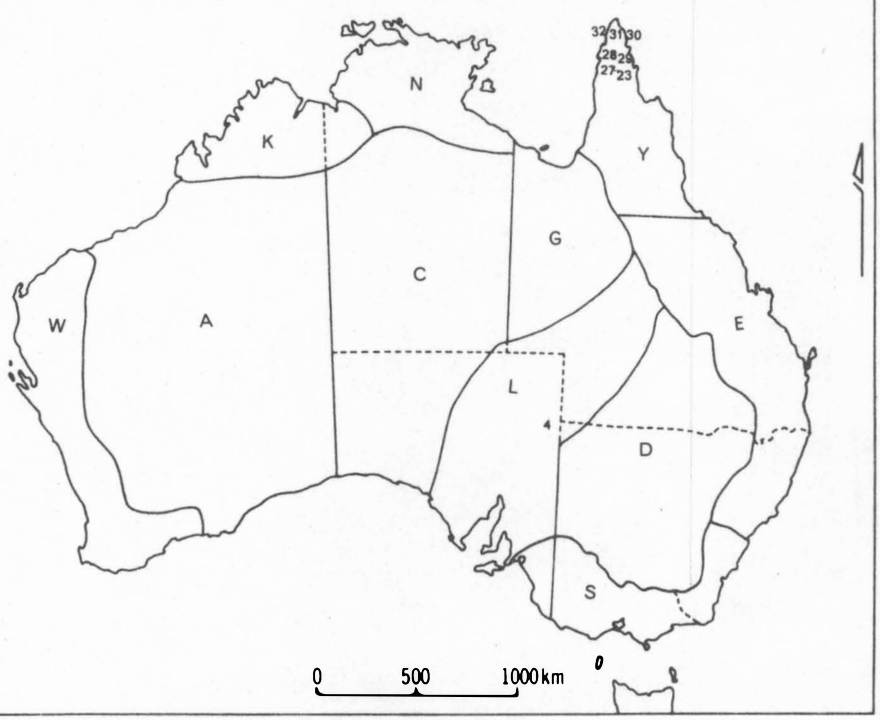
Map 15: /l ḷ ḻ ly/



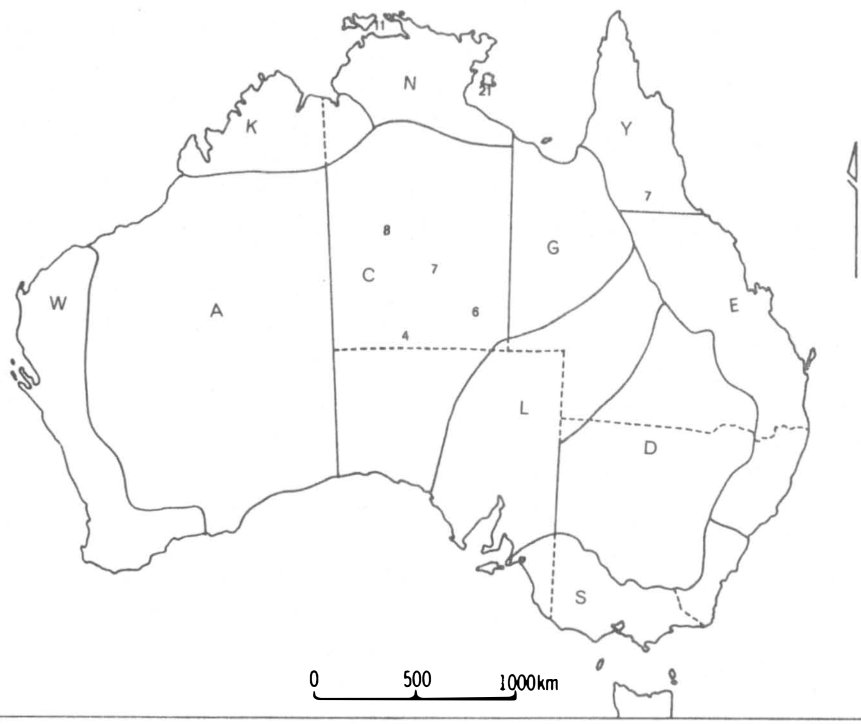
Map 16: Prestopping and Prepalatalisation



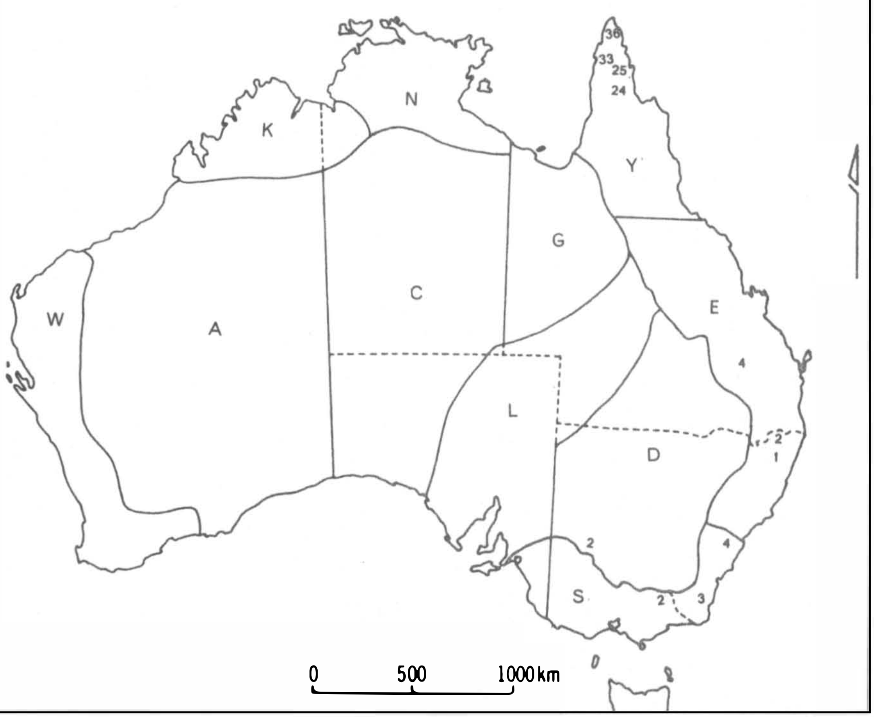
Map 17: Rhotic Release



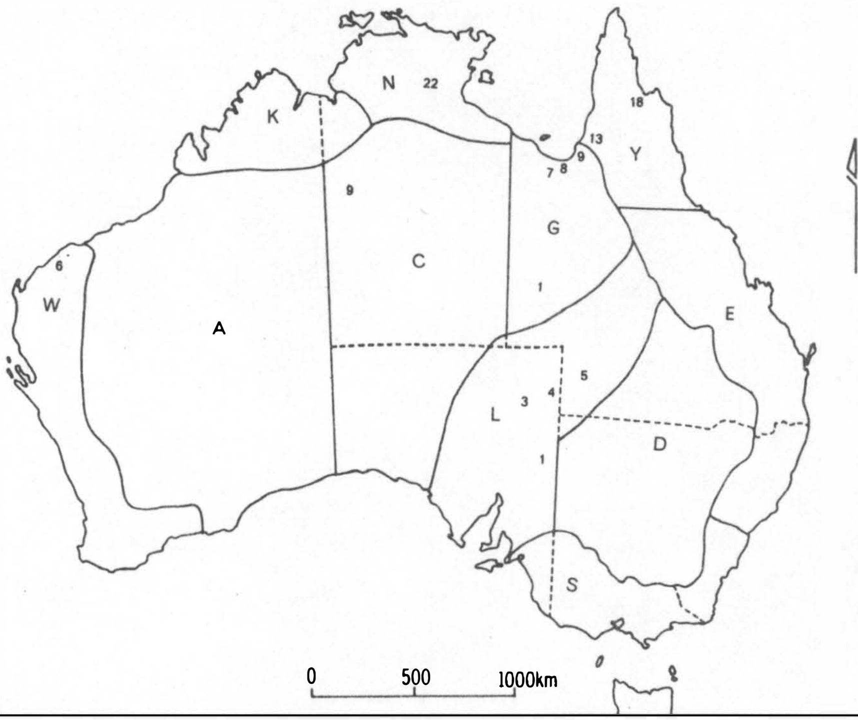
Map 18: Labialisation



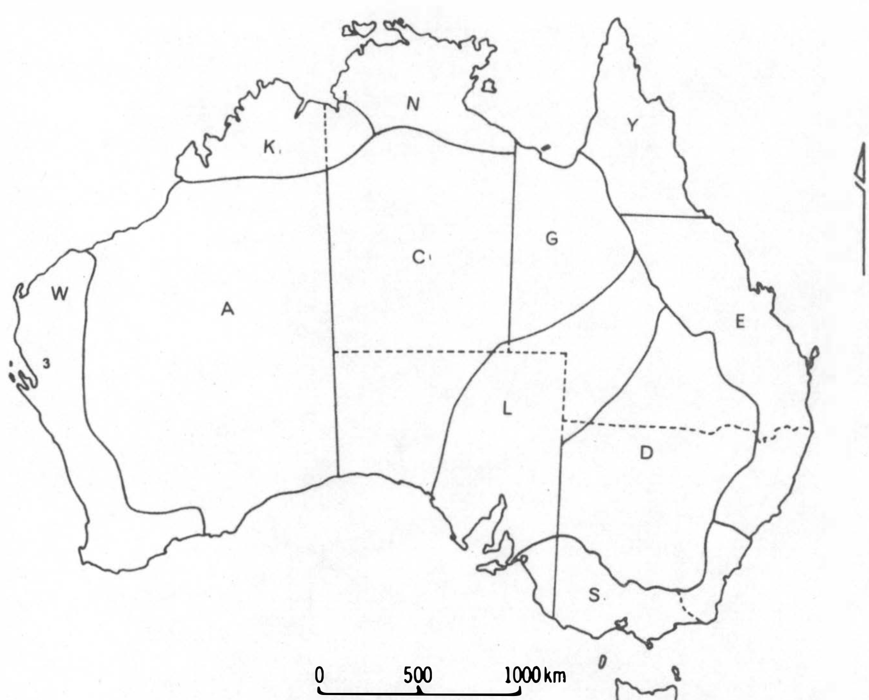
Map 19: /r/



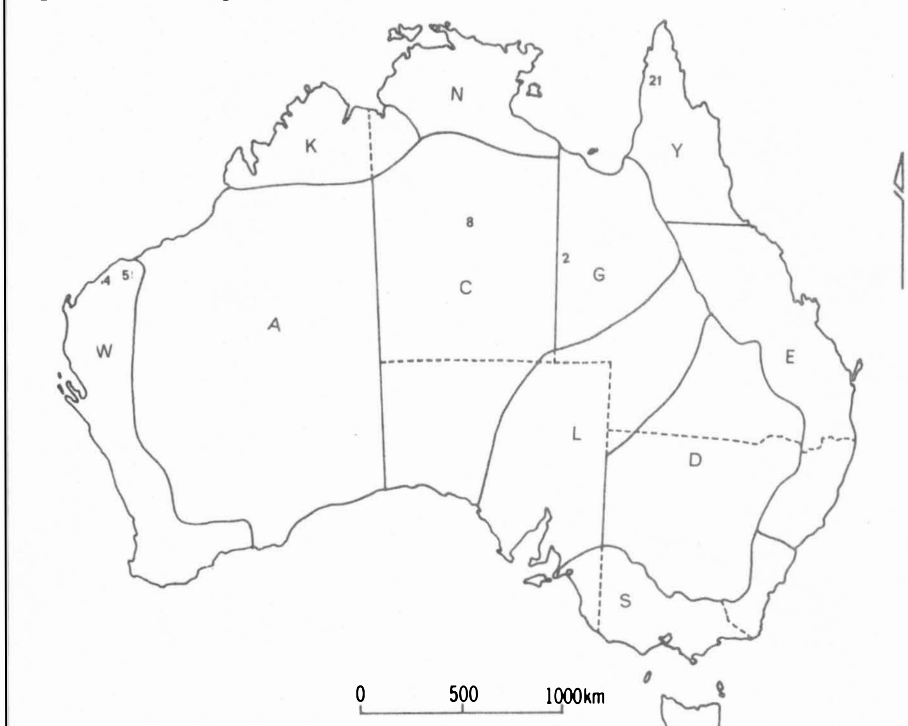
Map 20: /R r ř/



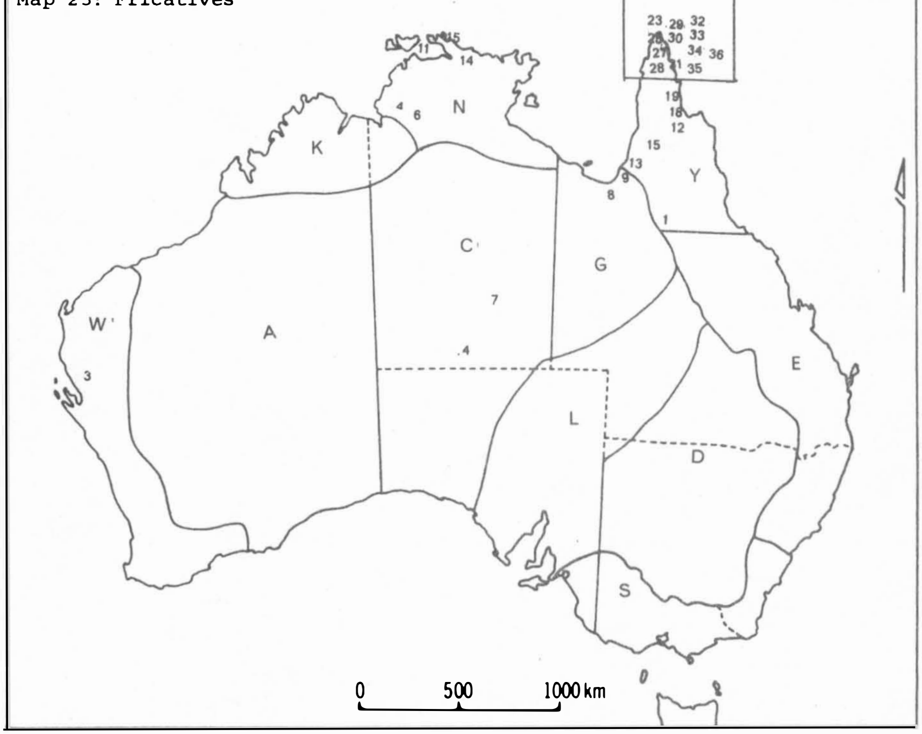
Map 21: Residue Rhotics



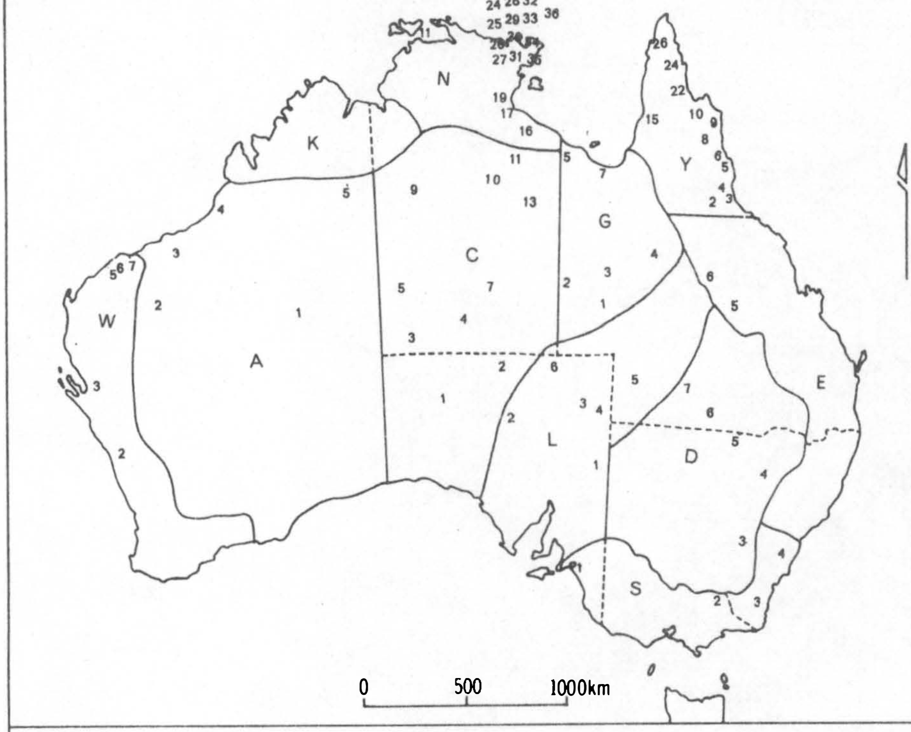
Map 22: 3-Glide Systems



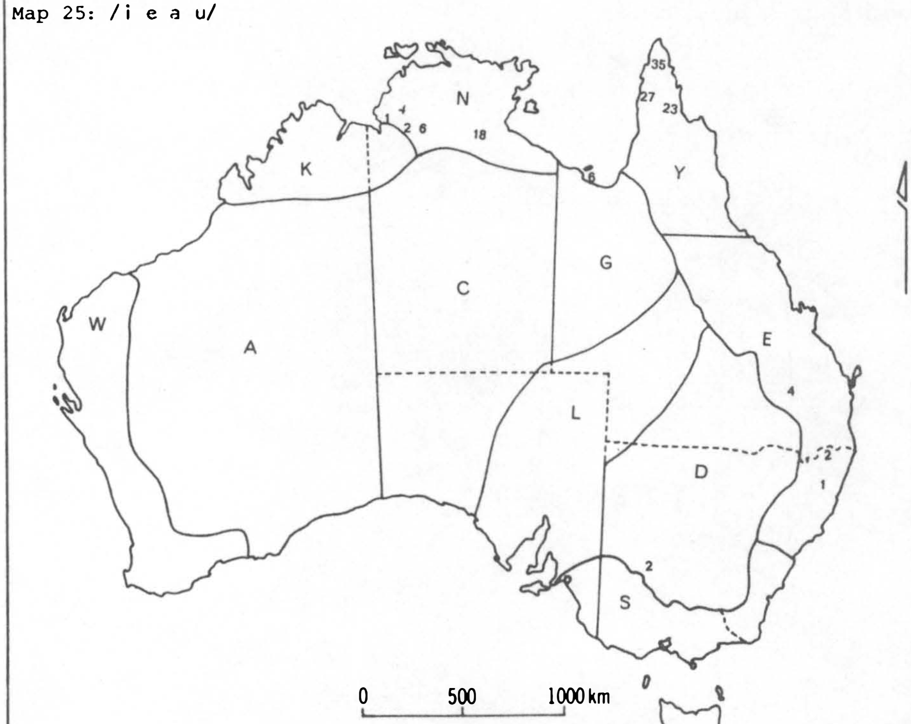
Map 23: Fricatives



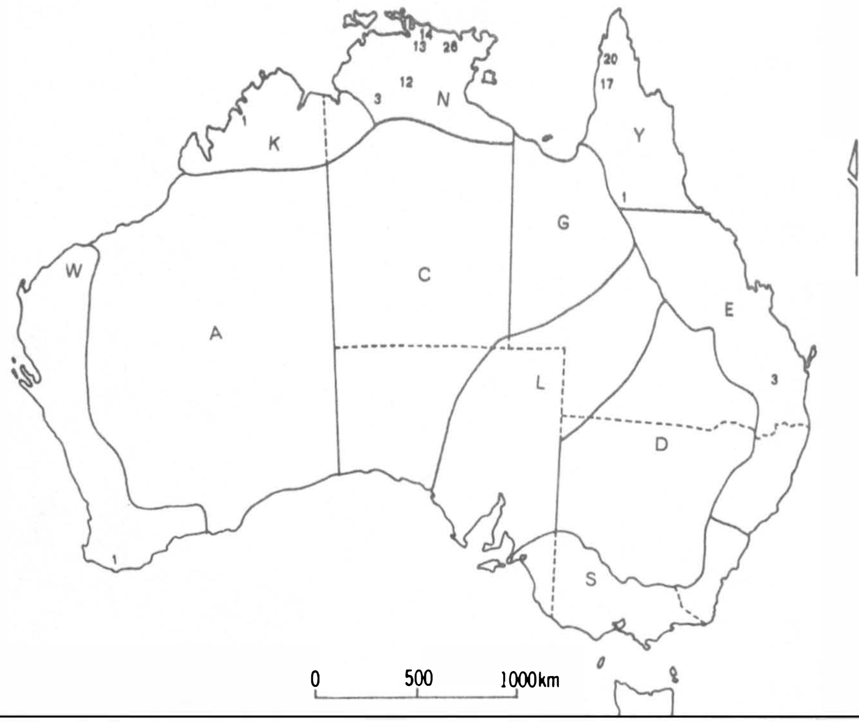
Map 24: /i a u/



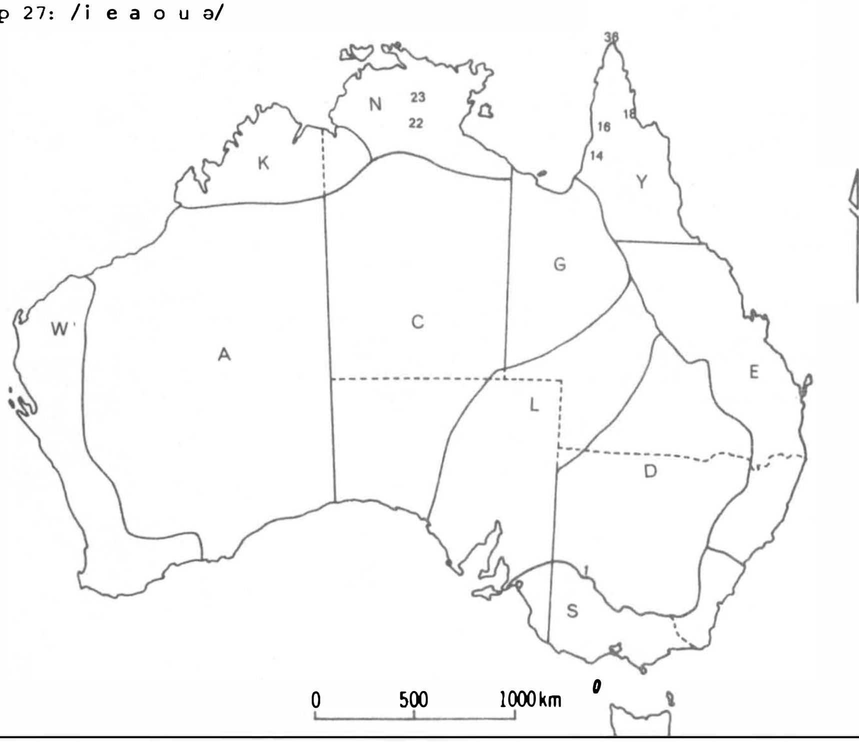
Map 25: /i e a u/



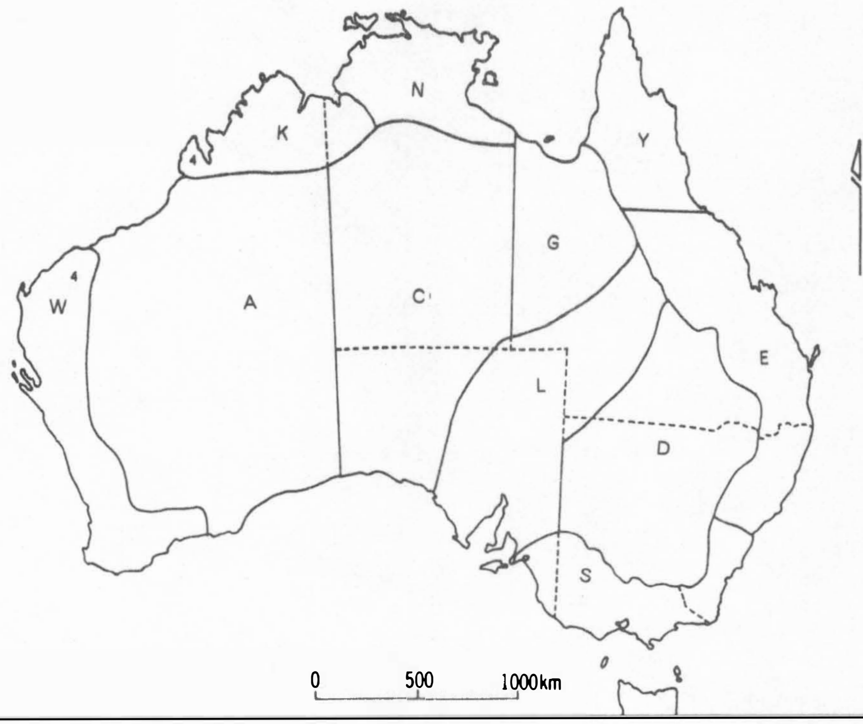
Map 26: /i e a o u/



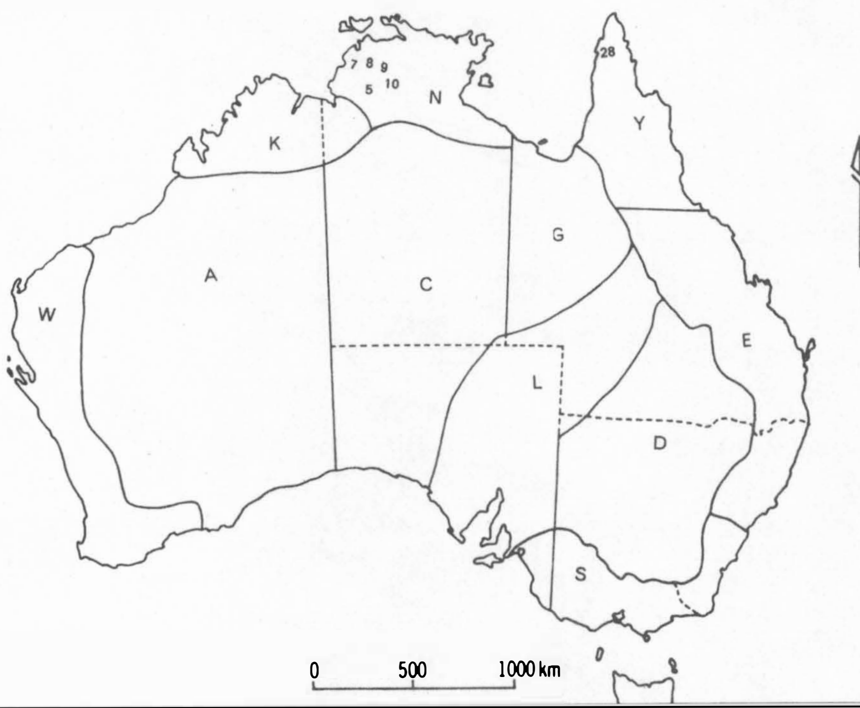
Map 27: /i e a o u ə/



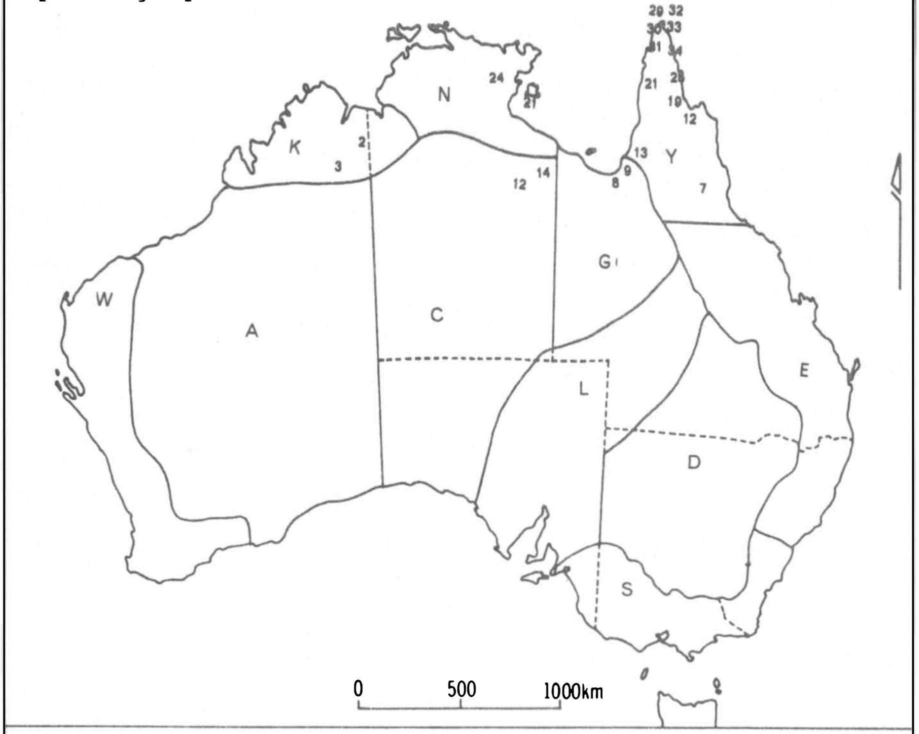
Map 28: /i a o u/



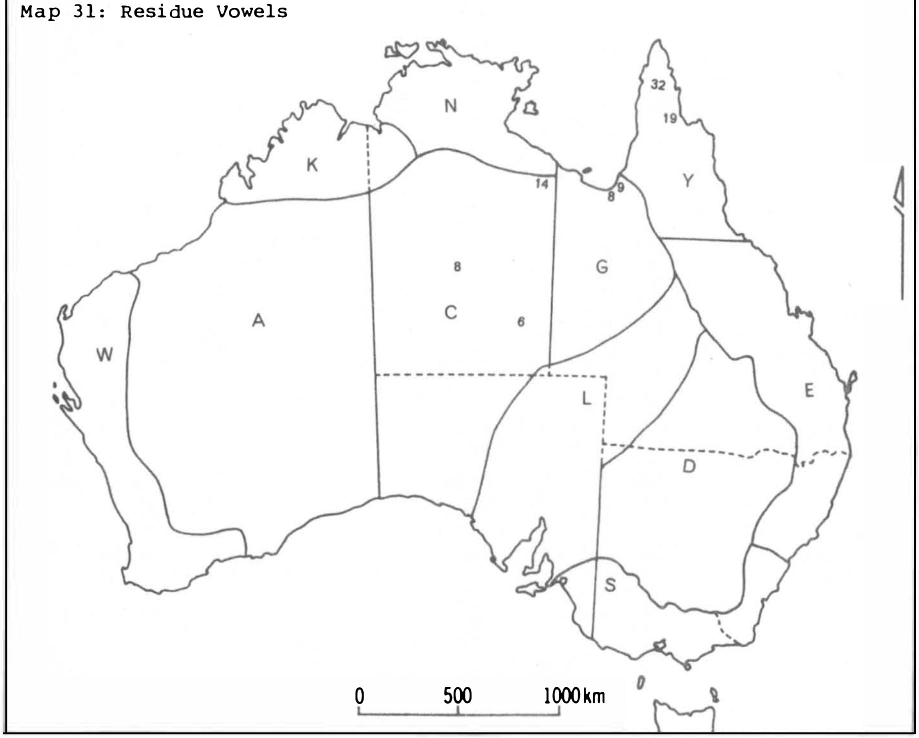
Map 29: /i e a u ə/



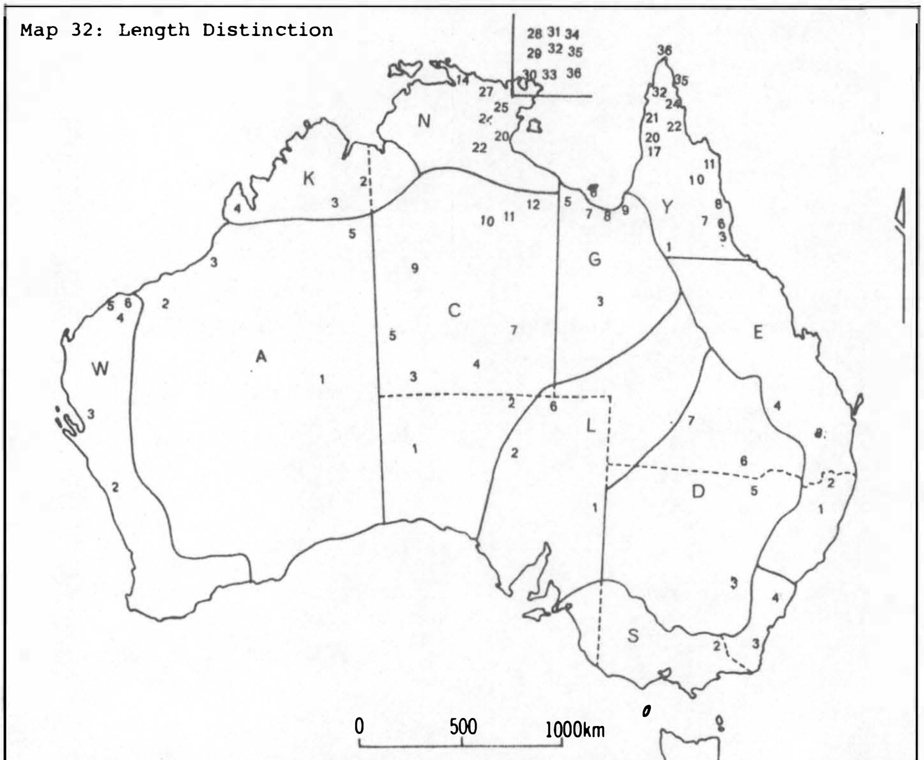
Map 30: Ungrouped Vowels



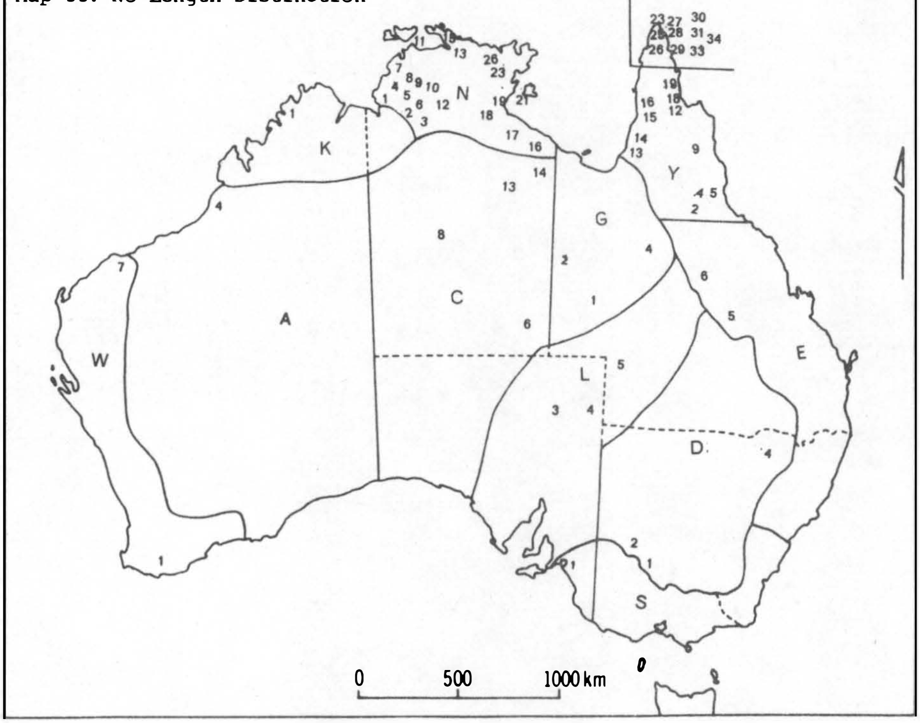
Map 31: Residue Vowels



Map 32: Length Distinction



Map 33: No Length Distinction



APPENDIX 2

Language References

Order: a, u, b/p, g/k, dy/dj, dh/th, d/t, m, ng, ny/nj, n, l, r, w, y.

The number after each language name indicates the A.I.A.S. area number.

Andiljaugwa (N151)
Dixon, R.M.W. Personal communication
Stoker 1976

Alyawarra (C14)
Breen 1967
Koch, H. Personal communication
Turtle 1977
Yallop 1977

Alawa (N92)
Sharpe 1972

Aridingidigh (Y35)
Hale 1959-60, 1976a

Andagirinja (C5)
Brown 1977

Andageribina (C12)
Breen 1967, 1977a

Aranda (C8)
Capell 1967
Koch, H. Personal communication
O'Grady, Voegelin and Voegelin 1966
Strehlow 1944

Arabana (L13)
Hale 1959a
Hercus 1972
O'Grady, Voegelin and Voegelin 1966

Awngdim (Y39.1)
Hale 1976a

Umbila (Y45)
Harris and O'Grady 1976

Umbuygamu (Y55)
Sommer 1976

Pitjantjatjara (C6)
Glass and Hackett 1970
University of Adelaide 1969

Burera (N82)
Dixon, R.M.W. Personal communication
Glasgow 1966
Glasgow and Glasgow 1962
Tryon 1974

Pita-pita (G6)
Blake and Breen 1971

Brinken (N7)
O'Grady, Voegelin and Voegelin 1966
Tryon 1974

Pungu-pungu (N11)
Tryon 1974

Bidyara (E37)
Breen 1973

Bard (K15)
Metcalfe 1975
O'Grady, Voegelin and Voegelin 1966

Pintupi (C10)
Hansen and Hansen 1969
Huttar 1976

Bailko (A55)
O'Grady, Voegelin and Voegelin 1966

Kaititj (C13)
Koch, H. Personal communication, 1974-

Kuuku-Yaʔu (Y22)
Rigsby 1972
Thompson 1976

Kurtjar (G33)
Black 1980
Keen 1968

Gunwinggu (N65)
Carroll 1976
Oates 1964

Kuthant (G31)
Black 1980

Gudandji (C26)
Aguas 1968

Kurama (W36)
O'Grady 1966
Wordick, F. Personal communication

Garadjari (A64)
Capell 1962

Gureng-gureng (E32)
Brasch 1975

Gidabal (E14)
Geytenbeek and Geytenbeek 1971

Gugada (C3)
Platt 1972

Kitja (K20)
Taylor and Taylor 1971

Kuuku-Thaypan (Y71)
Rigsby 1976

Koko-Bera (Y85)
Black and Alpher n.d.

Kalkatungu (G13)
Blake 1969

Guugu-Yimidhirr (Y82)
Haviland, J. Personal communication
Zwaan, de 1969

Gugu-Badhun (Y128)
Sutton 1973

Garawa (N155)
Furby 1974
Huttar and Kirton 1978

Gungabula (E35)
Breen 1973

Galpu (N139)
Wood 1977

Gubabuyngu (N112.1)
Dixon, R.M.W. Personal communication
O'Grady, Voegelin and Voegelin 1966

Gugu-Yalanji (Y99)
Oates, Oates et al. 1964
Wurm 1972

Kukatj (G28)
Black 1975
Breen 1976a

Kunjen (Y83)
Dixon 1970a
Sommer 1972

Gor-Nar (Y91)
Breen 1976b

Djamindjung (N18)
Walsh, M.J. Personal communication

Djaru (K12)
Tsunoda 1978

Djaabugay (Y106)
Hale 1976b

Dyirbal (Y123)
Dixon 1972

Djambarrpuyngu (N115)
Henley, J. Personal communication, 1978a

Djeebana (N74)
McKay 1975a

Djabu (N145)
Henley, J. Personal communication, 1978b

Djingili (C22)
Chadwick 1975
Hale 1960a

Thargari (W21)
Austin, P. Personal communication
Klokeid 1969

Dharawal (S59)
Eades 1976

Dhurga (S53)
Eades 1976

Thaayore (Y69)
Hall 1968

Dalabon (N76)
Capell 1962
O'Grady, Voegelin and Voegelin 1966

Tiwi (N20)
Breen 1977b
Osborne 1974

Datiway (N116.F)
Schebeck 1967

Diyari (L17)
Austin 1977, 1978a
Trefry 1974

Mbara (Y131)
Sutton 1976

Maung (N64)
Capell 1962
O'Grady, Voegelin and Voegelin 1966

Madi-madi (D8)
Hercus 1969

Maranunggu (N13)
Tryon 1970

Mulurudji (Y97)
O'Grady, Voegelin and Voegelin 1966

Malag-malag (N22)
Birk 1975

Malyangapa (L8)
Austin 1978b
O'Grady, Voegelin and Voegelin 1966

Mantjiltjara (A51.1)
Marsh 1969

Murinbata (N3)
Walsh 1972-, 1976

Mpakwithi (Y20)
Crowley 1975a, 1981

Mara (N112)
Busby 1978
Hale 1959b

Mayali (N44)
Merlan 1976

Muruwari (D32)
Oates 1976

Mandelbingu (N116.0)
Schebeck 1967

Mabuiag (Y1-4)
Klokeid 1971

Mbabaram (Y115)
Dixon, R.M.W. Personal communication

Mbeiwum (Y41)
Hale 1976a

Mbalidjan (Y25)
Hale 1976a

Margany (D42)
Breen 1981

Nganjaywana (D24)
Crowley 1976

Nggod (Y36)
Hale 1976a

Ngawun (G17)
Breen 1972-

Ngarndji (C22.1)
Chadwick 1971

Ngarigu (S46)
Hercus 1969

Ngaḷuma (W38)
O'Grady, Voegelin and Voegelin 1966

Ngarla (W40)
O'Grady, Voegelin and Voegelin 1966

Ngengomeri (N17)
Tryon 1974

Ngiyamba (D10.1)
Donaldson 1977

Ngarinjin (K18)
Coate and Oates 1970

Ngangikurrungurr (N8)
Courtenay 1976

NjungaR (W1-2)
Douglas 1976

Nyangumarda (A61)
Hoard and O'Grady 1976
O'Grady 1964

Nanta (W14)
O'Grady, Voegelin and Voegelin 1966

Nunggubuyu (N128)
Hughes and Healey 1971
Hughes and Leeding 1971a,b

Ndraʔangid (Y39)
Hale 1976

Lenngidigh (Y26)
Hale 1976a

Ludigh (Y12)
Hale 1976a

Lardil (G38)
Klokeid 1976

Lama-lama (Y58)
Laycock 1969

Ritharngu (N104)
Heath 1978

Rembarnga (N73)
McKay 1975b

Wangganguru (L27)
Hercus 1972

Wanggumara (L25)
Breen 1974

Wangurri (N134)
Schebeck 1967

Wagilak (N106)
Schebeck 1967

Warramiri (N131)
Schebeck 1967

Wadyiginy (N6)
Tryon 1974

Wikmumin (Y43)
O'Grady, Voegelin and Voegelin 1966

Wambaya (C19)
Campbell 1976

Walmatjari (A66)
Hudson and Richards 1969

Wargamay (Y134)
Dixon 1981

Waramunga (C18)
Capell 1953
Chakravarti 1967
Hale 1959c
Wurm 1972

Wikmunkan (Y57)
Hale 1959d
Sayers 1964, 1976

Wik-Ep (Y52)
Hale 1960b

Wemba-wemba (D1)
Hercus 1969

Waḍaman (N35)
Merlan 1976

Waalubal (E12.1)
Crowley 1978

Waka-waka (E28)
Wurm 1976

Walpiri (C15)
Capell 1962
Jagst 1975

Waḷuwara (G10)
Breen 1971

Warungu (Y133)
Tsunoda 1974

Yanyula
Hale 1959e
Huttar and Kirton 1978
Kirton 1967

Yandruwandha (L18)
Breen 1967-, 1976c

Yathaikana (Y8)
Crowley, T. Personal communication, 1975b

Yukulta (G34)
Keen 1970, 1972

Yinytyiparnti (W37)
O'Grady 1966
Wordick, F. Personal communication

Yuwaalaraay (D23)
Williams 1976

Yiwadja (N39)
Capell 1962
O'Grady, Voegelin and Voegelin 1966

Yir-Yoront (Y72)
Alpher 1976
Black and Alpher n.d.

Yinwum (Y29)
Hale 1976a

Yidiny (Y117)
Dixon 1977

Yanhangu (N99.1)
Schebeck 1967

Yaraldi (S8)
McDonald 1977

BIBLIOGRAPHY

References cited as unpublished can be located in the library of the Australian Institute of Aboriginal Studies (A.I.A.S.).

AGUAS, E.F.

1968 'Gudandji'. *PL*, A-14:1-20.

ALPHER, B.

1976 'Phonological Peculiarities of Yir-Yoront Song Words'. In Sutton, ed. 1976:78-83.

AUSTIN, P.

1977 Diyari fieldnotes and tapes. (by permission)

1978a A Grammar of the Diyari Language of North East South Australia. Ph.D. thesis, Australian National University, Canberra.

1978b Outline of a sketch grammar of the Malyangapa language. Unpublished paper.

BIRK, D.B.W.

1975 'The Phonology of MalakMalak'. *PL*, A-39:59-78.

BLACK, P.

1975 Kukatj: final report. Unpublished paper (by permission).

1980 'Norman Pama Historical Phonology'. In B. Rigsby and P. Sutton, eds *PL*, A-59:181-239.

BLACK, P. and B. ALPHER

n.d. Writing Koko-Bera and Koko-Minjen. Unpublished paper.

BLAKE, B.J.

1969 *The Kalkatungu Language: A Brief Description.* AAS 20, L8. Canberra: A.I.A.S.

BLAKE, B.J., ed.

1974 *Papers in Australian Aboriginal Languages. Linguistic Communications* 14. Melbourne: Monash University.

BLAKE, B.J. and J.G. BREEN

1971 *The Pitta-Pitta Dialects. Linguistic Communications* 4. Melbourne: Monash University.

BLAKE, B.J. and R.M.W. DIXON

1979 Introduction to Dixon and Blake, eds 1979:1-25.

BRASCH, S.

1975 Gureŋ Gureŋ: A Language of the Upper Burnett River South-east Queensland. B.A. (Hons.) subthesis, Australian National University, Canberra.

BREEN, J.G.

1967 Andagerebina. Unpublished data.

1967- Yandruwandha fieldnotes and tapes.

1971 A Description of the Waḷuwara Language. M.A. thesis, Monash University, Victoria.

1972- Ngawun. Unpublished data (by permission).

1973 *Bidyara and Gungabula: Grammar and Vocabulary. Linguistic Communications* 8. Melbourne: Monash University.

1974 'Notes on an Original Orthography (or The Dixon System of Spelling)'. In Blake, ed. 1974:59-68.

1976a 'Gugadj and Gog-Nar: a Contrastive Sketch'. In Sutton, ed. 1976:151-162.

1976b 'An Introduction to Gog-Nar'. In Sutton, ed. 1976:243-259.

1976c 'Yandruwandha'. In Dixon, ed. 1976:594-597; 750-756.

1977a 'Andegerebinha Vowel Phonology'. *Phonetica* 34:371-391.

1977b A reanalysis of Tiwi /o/. Unpublished paper.

1981 'Margany and Gunya Grammar'. In Dixon and Blake, eds, 1981. In press.

BROWN, M.

1977 Morphological Reconstruction of Proto-Western Desert. B.A. (Hons.) thesis, Australian National University, Canberra.

BUSBY, P.

1978 A statement of Mara phonology and pronominals. Unpublished paper.

CAMPBELL, S.

1976 An outline of the grammar of Wambaya. Unpublished paper.

CAPELL, A.

1953 'Notes on the Waramunga Language, Central Australia'. *Oceania* 23/4:297-311.

1962 *Some Linguistic Types in Australia. Oceania Linguistic Monographs* 7.

1967 'Sound Systems in Australia'. *Phonetica* 16:85-110.

CARROLL, P.J.

1976 Kunwinjku: A Language of Western Arnhem Land. M.A. thesis, Australian National University, Canberra.

CHADWICK, N.

1971 'Ngarndji Wordlist and Phonological Key'. *Papers on the Languages of Australian Aboriginals*:34-45. AAS 38, L16. Canberra: A.I.A.S.

1975 *A Descriptive Study of the Djingili Language*. AAS, RRS2. Canberra: A.I.A.S.

CHAKRAVARTI, P.

1967 A report on WaRaŋungu. Unpublished paper.

COATE, H.H.J. and L.F. OATES

1970 *A Grammar of Ngarinjin, Western Australia*. AAS 25, L10. Canberra: A.I.A.S.

COURTENAY, K.

1976 *Nangikuruŋgurr Alphabet Book*. Darwin: School of Australian Linguistics, Darwin Community College.

CROWLEY, T.M.

1975a Mpakwithi fieldnotes and tapes.

1975b Yadhaykenu fieldnotes and tapes.

1976 'Phonological Change in New England'. In Dixon, ed. 1976: 19-50.

1978 *The Middle Clarence Dialects of Bandjalang*. AAS, RRS12. Canberra: A.I.A.S.

1981 'The Mpakwithi Dialect of Anguthimri'. In Dixon and Blake, eds, 1981. In press.

DIXON, R.M.W.

1970a 'Olgolo Syllable Structure and What They are Doing About It'. *Linguistic Inquiry* 1/2:273-276.

1970b 'Proto-Australian Laminals'. *Oceanic Linguistics* 9/2:79-103.

1972 *The Dyirbal Language of North Queensland*. London: Cambridge University Press.

1977 'Some Phonological Rules in Yidin^y'. *Linguistic Inquiry* 8/1:1-34.

1980 *The Languages of Australia.* Cambridge: Cambridge University Press.

1981 'Wargamay Grammar'. In Dixon and Blake, eds, 1981. In press.

DIXON, R.M.W., ed.
1976 *Grammatical Categories in Australian Languages.* *AAS*, L22. Canberra: A.I.A.S.

DIXON, R.M.W. and B.J. BLAKE, eds
1979 *Handbook of Australian Languages*, vol.1. Canberra: ANU Press.

1981 *Handbook of Australian Languages*, vol.2. Canberra: ANU Press, and Amsterdam: John Benjamins.

DONALDSON, T.
1977 A Description of Ngiyamba:, the Language of the Waŋa:ybuwan People of Central Western New South Wales. Ph.D. thesis, Australian National University, Canberra.

DOUGLAS, W.H.
1976 *The Aboriginal Languages of the South-West of Australia.* 2nd edition. *AAS* RRS9. Canberra: A.I.A.S.

EADES, D.K.
1976 *The Dharawal and Dhurga Languages of the New South Wales South Coast.* *AAS*, RRS8. Canberra: A.I.A.S.

FERGUSON, C.A.
1966 'Assumptions About Nasals: A Sample Study in Phonological Universals'. In J.H. Greenberg, ed. *Universals of Language*, 53-60. (2nd edition). Massachusetts: M.I.T. Press.

FURBY, C.E.
1974 'Garawa Phonology'. *PL*, A-37:1-11.

GEYTENBEEK, B. and H. GEYTENBEEK
1971 *Gidabal Grammar and Dictionary.* *AAS* 43, L.17. Canberra: A.I.A.S.

GLASGOW, D.
1966 *Notes on the Burera Sound System (North Arnhem Coast).* Darwin: Education Section of the Welfare Branch, N.T.A.

GLASGOW, D. and K. GLASGOW
1962 'The Phonemes of Burera'. *PL*, A-10:1-14.

GLASS, A. and D. HACKETT
1970 *Pitjantjatjara Grammar: A Tagmemic View of the Ngaanyatjara (Warburton Ranges) Dialect.* AAS 34, L13. Canberra: A.I.A.S.

HALE, K.L.
1959a Arabana fieldnotes and tapes.

1959b Mara fieldnotes and tapes.

1959c Waṛumuŋu fieldnotes and tapes.

1959d Wik-munkaṉ fieldnotes and tapes.

1959e Yanyula fieldnotes and tapes.

1959-60 Northern-Paman fieldnotes. Unpublished data.

1960a Djingili fieldnotes and tapes.

1960b Wik-Ep or Wik-meʔṉ fieldnotes and tapes.

1976a 'Phonological Developments in a Northern Paman Language: Uradhi'. In Sutton, ed. 1976:41-49.

1976b 'T^ya·pukay (Djaabugay)'. In Sutton, ed. 1976:236-242.

HALL, A.H.
1968 A Depth-Study of the Thaayorr Language of the Edward River Tribe, Cape York Peninsula. M.A. thesis, University of Queensland.

HANSEN, K.C. and L.E. HANSEN
1969 'Pintupi Phonology'. *Oceanic Linguistics* 8/2:153-170.

HARRIS, B.P. and G.N. O'GRADY

1976 'An Analysis of the Progressive Morpheme in Umpila Verbs: A Revision of a Former Attempt'. In Sutton, ed. 1976: 165-212.

HEATH, J.

1978 *Linguistic Diffusion in Arnhem Land*. *AAS*, RRS13. Canberra: A.I.A.S.

HENLEY, J.

1978a Language elicitation notes and tapes.

1978b Video recording and notes.

HERCUS, L.A.

1969 *The Languages of Victoria: A Late Survey*. *AAS* 17, L5 and L6. Canberra: A.I.A.S.

1972 'The Pre-stopped Nasal and Lateral Consonants of Arabana-Waŋgaŋuru'. *Anthropological Linguistics* 14/8:293-305.

HOARD, J.E. and G.N. O'GRADY

1976 'Nyangumarda Phonology: a Preliminary Report'. In Dixon, ed. 1976:51-77.

HUDSON, J. and E. RICHARDS

1969 'The Phonology of Walmatjari'. *Oceanic Linguistics* 8/2: 171-189.

HUGHES, E.J. and A. HEALEY

1971 'The Nunggubuyu Verb'. *Papers on the Languages of Australian Aboriginals*: 46-57. *AAS* 38, L16. Canberra: A.I.A.S.

HUGHES, E.J. and V.J. LEEDING

1971a 'The Phonemes of Nunggubuyu'. *Papers on the Languages of Australian Aboriginals*: 72-81. *AAS* 38, L16. Canberra: A.I.A.S.

1971b 'A Tentative Description of Nunggubuyu Clauses'. *Papers on the Languages of Australian Aboriginals*: 58-71. *AAS* 38, L16. Canberra: A.I.A.S.

HUTTAR, G.L.
1976 'Notes on Pintupi Phonology'. *Talanya* 3:14-24.

HUTTAR, G.L. and J. KIRTON
1978 Contrasts in Yanyuwa consonants. Paper delivered at the 1978 Australian Linguistic Society Conference, Canberra.

JAGST, L.
1975 'Ngardilpa (Warlpiri) Phonology'. *PL*, A-39:21-57.

KEEN, S.L.
1968 Kurtjar fieldnotes and tapes.

1970 Yukulta fieldnotes and tapes.

1972 A Description of the Yukulta Language - an Australian Aboriginal Language of North-west Queensland. M.A. thesis, Monash University.

KIRTON, J.F.
1967 'Anyula Phonology'. *PL*, A-10:15-28.

KLOKEID, T.J.
1969 *Thargari Phonology and Morphology*. *PL*, B-12.

1971 An outline of Mabuiag phonology. Unpublished paper.

1976 Topics in Lardil Grammar. Ph.D. thesis, Massachusetts Institute of Technology.

KOCH, H.
1974- Kaititj fieldnotes and tapes.

LAYCOCK, D.C.
1969 'Three Lamalamic Languages of North Queensland'. *PL*, A-17:71-97.

McDONALD, M.
1977 A Study of the Phonetics and Phonology of Yaraldi and Associated Dialects. M.A. thesis, Australian National University, Canberra.

McKAY, G.R.
1975a Medial stop gemination in two central Arnhem Land languages. Unpublished paper.

1975b Rembarnga: A Language of Central Arnhem Land. Ph.D. thesis, Australian National University, Canberra.

MARSH, J.
1969 'Mantjiltjara Phonology'. *Oceanic Linguistics* 8/2:131-152.

MERLAN, F.
1976 Linguistic report 1976. Unpublished paper (by permission).

METCALFE, C.D.
1975 *Baṛdi Verb Morphology (Northwestern Australia)*. *PL*, B-30.

OATES, L.F.
1964 *A Tentative Description of the Gunwinggu Language*. *Oceania Linguistic Monographs* 10. Sydney: University of Sydney.

1976 'Muruwari'. In Dixon, ed. 1976:244-249; 342-347; 472-475.

OATES, W.J., L.F. OATES et al.
1964 *Gugu-Yalanji and Wik-Munkan Language Studies*. *AAS* 2, L1. Canberra: A.I.A.S.

O'GRADY, G.N.
1964 *Nyangumaṭa Grammar*. *Oceania Linguistic Monographs* 9. Sydney: University of Sydney.

1966 'Proto-Ngayarda Phonology'. *Oceanic Linguistics* 5/2:71-130.

O'GRADY, G.N., C.F. VOEGELIN and F.M. VOEGELIN
1966 *Languages of the World: Indo-Pacific Fascicle Six*. *Anthropological Linguistics* 8/2.

OSBORNE, C.R.

1974 *The Tiwi Language*. *AAS* 55, L21. Canberra: A.I.A.S.

PLATT, J.T.

1972 *An Outline Grammar of the Gugada Dialect: South Australia*. *AAS* 48, L20. Canberra, A.I.A.S.

RIGSBY, B.

1972 Kuuku-Yaˀu fieldnotes and tapes.

1976 'Kuku-Thaypan Descriptive and Historical Phonology'. In Sutton, ed. 1976:68-77.

SAYERS, B.J.

1964 'The Phonemes of Coen Wik-Munkan'. In Oates and Oates et al. 1964:51-56.

1976 'Interpenetration of Stress and Pitch in Wik-Munkan Grammar and Phonology'. *PL*, A-42:31-79.

SCHEBECK, B.

1967 Final report on linguistic fieldwork carried out under research grant from the A.I.A.S. from 23rd November 1964 until 31st March 1967. Unpublished paper.

SHARPE, M.C.

1972 *Alawa Phonology and Grammar*. *AAS* 37, L15. Canberra: A.I.A.S.

SOMMER, B.A.

1972 *Kunjen Syntax: a Generative View*. *AAS* 45, L19. Canberra: A.I.A.S.

1976 'Umbuygamu: the Classification of a Cape York Peninsula Language'. *PL*, A-47:13-31.

STOKES, J.

1976 Andiljaugwa unpublished fieldnotes.

STREHLOW, T.G.H.

1944 *Aranda Phonetics and Grammar*. *Oceania Monographs* 7. Sydney: Australian National Research Council.

SUTTON, P.J.
1973 Gugu-Badhun and its Neighbours. M.A. thesis, Macquarie University, Sydney.

1976 'The Diversity of Initial Dropping Languages in Southern Cape York'. In Sutton, ed. 1976:102-123.

SUTTON, P.J., ed.
1976 *Languages of Cape York*. *AAS*, RRS6. Canberra: A.I.A.S.

TAYLOR, P. and J. TAYLOR
1971 'A Tentative Statement of Kitja Phonology'. *Papers on the Languages of Australian Aboriginals*: 100-119. *AAS* 38, L16. Canberra: A.I.A.S.

THOMPSON, D.A.
1976 'Kuuku Yaʔu'. In Dixon, ed. 1976:208-211; 329-331; 450-452.

TREFRY, D.
1974 The Theory of Segmental Phonology and its Application to Dieri. Ph.D. thesis, Macquarie University, Sydney.

TRYON, D.T.
1970 *An Introduction to Maranungku (Northern Australia)*. *PL*, B-15.

1974 *Daly Family Languages, Australia*. *PL*, C-32.

TSUNODA, T.
1974 A Grammar of the Waruŋu Language, North Queensland. M.A. thesis, Monash University.

1978 The Djaru Language of Kimberley, Western Australia. Ph.D. thesis, Monash University.

TURTLE, N.
1977 'Alyawarra Phonology'. In J. Hudson, ed. *Five Papers in Australian Phonologies: Work Papers of SIL - AAB*, Series A, vol.1:1-56. Darwin: Summer Institute of Linguistics, Australian Aborigines Branch.

UNIVERSITY OF ADELAIDE

1969 *Pitjantjatjara Language Course Lessons 1-4.* (By permission).

WALSH, M.J.

1972- Murinbata fieldnotes and tapes.

1976 The Muɹinypata Language of North-West Australia. Ph.D. thesis, Australian National University, Canberra.

WILLIAMS, C.J.

1976 Yuwaaliyaay and Yuwaalaraay Dialects of North-Central N.S.W. B.A. (Hons.) subthesis, Australian National University, Canberra.

1980 *A Grammar of Yuwaalaraay.* *PL*, B-74.

WOOD, R.K.

1977 'Some Aspects of Galpu Phonology'. *Talanya* 4:24-29.

WURM, S.A.

1972 *Languages of Australia and Tasmania.* The Hague: Mouton.

1976 'Accusative Marking in Duungidjawu (Waga-Waga). In Dixon, ed. 1976:106-111.

YALLOP, C.

1977 *Alyawarra. An Aboriginal Language of Central Australia.* AAS, RRS10. Canberra: A.I.A.S.

ZWAAN, J.D. de

1969 *A Preliminary Analysis of Gogo-Yimidjir.* AAS 16, L5. Canberra: A.I.A.S.

DJINANG VERB MORPHOLOGY

BRUCE E. WATERS

1. INTRODUCTION

Djinang[1] is a suffixing language of north-central Arnhem Land. It is spoken by approximately 300 people, most of whom live on the mainland south of the Crocodile islands and west of the Glyde river.[2] Djinang has been classified (Voegelin and Voegelin 1977) as one of the Murngic group of languages in the Pama-Nyungan family.

The purpose of this paper is to describe the morphology of Djinang verbs, and by means of morphophonemic rules, to reduce the seventeen observed verb classes to three major classes. A second purpose is to obtain a minimal set of distinctive features suitable for handling the phonological concepts of contrast, natural classes, and morphophonemic rules, as pertains to the analysis of Djinang verbs presented in this paper.

The verb morphology data described in this paper was collected during a two-week period, for a workshop held by the Summer Institute of Linguistics in Darwin, 1977. Appreciation is expressed to Thomas Mulumbuk and John Weluk for their valuable assistance in providing data during the workshop. The corpus of verbs was enlarged during a further seven months of fieldwork during 1978. I extend thanks to Manbarrarra and Jack Merrichi who both contributed data during that time. I am indebted to Joyce Ross who provided an explanation of the semantics of the tense/aspect[3] system of Gumatj, another Murngic language. This was the information I needed for an adequate understanding of the semantics of the various tense/aspect suffixes of Djinang.

I also thank Alan Healey for useful suggestions about the presentation of charts; and George Huttar for suggesting the use of the features 'distributed' and 'peripheral', as well as his valuable assistance with advice on presentation and on the analysis itself.

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2. ORTHOGRAPHY

The following symbols are used for Djinang phonemes:

CHART 1: CONSONANT PHONEMES

	labial	apico-alveolar	apico-postalveolar	lamino-postalveolar	velar
voiceless stops	p	t	rt	ch	k
voiced stops	b	d	rd	j	g
nasals	m	n	rn	ny	ng
laterals		l	rl		
glides and rhotics	w	rr	r	y	

The apico-alveolar rhotic, rr, is trilled.

CHART 2: VOWEL PHONEMES

	non-back	back
non-low	i	u
low		a

Disambiguation of potentially ambiguous clusters of symbols is achieved by placing a period, ., between them.

3. SEMANTIC CATEGORIES OF SUFFIXES

Djinang verbs are comprised of a stem followed by an obligatory tense/aspect/mood suffix,[4] which in turn may optionally be followed by the suffix -ban.[5] As the latter leads to no subclassification of verbs, I will not deal with it any further in this paper.

There are twelve semantic categories for every verb, which are coded by seven different suffixal forms. Consequently, five of the forms each code two different semantic categories, as outlined in Table 1.

TABLE 1: SEMANTIC CATEGORIES OF SUFFIXES

non-past	
non-past irrealis[6]	
yesterday past[7]	present continuous
today past continuous	remote past continuous
imperative	yesterday past irrealis
today past irrealis	remote past irrealis
today past	remote past

The suffix coding non-past irrealis undergoes precisely the same morphophonemic processes as does the suffix coding today past irrealis and remote past irrealis. For the three major verb classes, it takes the forms: -nyirgi (classes I and III), and -rnirgi (class II).[8] The suffix coding non-past irrealis and the suffix coding today past irrealis undergo essentially the same morphophonemic processes. Since they both lead to the same verb subcategorisation, I have omitted one (the non-past irrealis) from further consideration in this paper.

For the purpose of brevity of reference, subsequent references to a suffix will be by just one of the semantic categories appropriate to it. The categories chosen, with abbreviatory conventions in parentheses, are as follows: non-past (non-pst), yesterday past (y-pst), today past continuous (t-pst-cont), imperative (imp), today past irrealis (t-pst-irr), and today past (t-pst).

4. VERB CLASSES

The charts in this section present a description of the different groups of verbs. When reading the charts, the following points should be borne in mind.

(a) Differentiation between groups of verbs is based on there being at least one significant difference in either the stem or in the set of inflectional suffixes.

(b) Only the final portion of the stem is given in the second column of each table, since this is the part of the stem governing the morphophonemic processes.

(c) The number of verbs in the data corpus which function according to the pattern of a given group is stated in parentheses in the second column.

(d) Braces around several phonemes indicate which phonemes occur at that position within the stem.

(e) If there is a change in the stem occurring in conjunction with a given suffix, the stem change is cited below that suffix.

(f) Information too detailed for inclusion in the charts is given in the form of footnotes.

(g) The symbol 'Ø' represents a zero morpheme (in the charts) or a zero segment (in the morphophonemic rules).

(h) The order of presentation of the suffixes in each of charts 3, 4, and 5, or elsewhere in this paper, has no significance whatsoever.

CHART 3: CLASS I VERBS

group	stem ending	non-pst	y-pst	t-pst-cont	imp	t-pst-irr	t-pst
1	{t n l / rt rd rn r} i mi, ra, rru (28)	-gi	-mi	-nyi	-wi i# → u#[9]	-nyiri	-ngili
2	{k / g} {u / a}, gi[10] (15)	-ngi	-mi	-nyi	-wi i# → u#	-nyiri	-ngili
3	r, rr (6)	-gi	-i-mi	-i-nyi	-u-wi	-i-nyiri	-i-ngili
4	pi, bi (7)	-gi	-mi b → p	-nyi	-wi i# → u#	-nyiri	-li
5	chi, ji (71)	-gi	-mi	-nyi i# → Ø#[11]	-wi i# → u#	-nyiri i# → Ø#[11]	-li
6	irregular[12] (2)	-Ø[13]	-mi	-nyi	-wi i# → u#	-nyiri	-li i# → a#
7	bu (5)	-ngi	-mi	-nyi	-wi	-nyiri	-pirni[14]
8	nya (3)	-ngi	-mi	-nyi	-wi	-nyiri	-ngirni

CHART 4: CLASS II VERBS

group	stem ending	non-pst	y-pst	t-pst-cont	imp	t-pst-irr	t-pst
9	{b j, m}irr (7)	-gi rr → ø	-nmi rr → ø	-ni rr → ø	-rri rr → ø	-rnir rr → ø	-jini
10	chi (3)	-gi	-nmi	-ni	-rri	-rnir	-jini
11	girr (3)	-gi	-nmi rr → ø	-ni rr → ø	-rri rr → ø	-rnir rr → ø	-jini
12	{p, b l}i (11)	-gi	-nmi	-ni	-rri	-rnir	-ni
13	{ch, j ng}il (4)	-gi	-nmi l → ø	-ni l → ø	-rri l → ø	-rnir l → ø	-ni l → ø

CHART 5: CLASS III VERBS

group	stem ending	non-pst	y-pst	t-pst-cont	imp	t-pst-irr	t-pst
14	{b k, m n rn ng, l}i (16)	-ji	-ø	-nyi	-yi	-nyiri	-ni
15	{ch k, m ng}irri (6)	-ji	-ø	-nyi	-yi	-nyiri	-ni rri → ø
16	rri (2) stems in this group have the form CVrri[15]	-ji	-ø[16]	-nyi[16]	-yi	-nyiri	-nyini[16]
17	chi, ji (26)	-ji	-rri	-nyi i → ø[11]	-yi	-nyiri i → ø[11]	-ni

Inspection of the imperative column for charts 3, 4, and 5, clearly shows that there are only three different forms for the imperative suffix: -wi for chart 1, -rri for chart 2, and -yi for chart 3. Furthermore, when the form of the imperative changes, there is a correlative change in the other columns also. It is for these reasons that I have postulated just the three major verb classes as exemplified by charts 3, 4, and 5. The implication of this is that the alternations between groups within a class are predictable by rule; hence in section 6. I shall present morphophonemic rules to handle the alternations.

The rules in section 6. will be written using distinctive features, so in section 5. I shall first give an inventory of the distinctive features needed.

5. THE DISTINCTIVE FEATURE SET

The majority of the distinctive features are required for establishing contrast between sound classes, but I give a further six features which are non-contrastive (at the systematic phonemic level) but which nevertheless are necessary for the morphophonemic rules and for deriving phonetic representations. At the time of writing, the phonology of Djinang has not been fully studied. It is therefore to be expected that further features than are given in this paper will be seen to be necessary for characterising sounds at the phonetic level.

TABLE 2: THE DISTINCTIVE FEATURE SET

contrastive		non-contrastive
syllabic	peripheral	segment
		continuant
distributed	anterior	high
sonorant	nasal	long
lateral	back	round
low	voice	delayed release

I have characterised the feature 'peripheral' as follows (compare McKay 1975:30):

> peripheral sounds are produced with a primary obstruction that is located at an extremity of the oral cavity; non-peripheral sounds are produced without an obstruction at an extremity of the oral cavity.

Thus 'non-peripheral' sounds correspond closely to 'coronal' sounds as defined by Chomsky and Halle (1968:304). However, the feature 'coronal' is not well-suited to a description of Djinang.

Firstly, the definition of the feature 'coronal' states that the raising of the tongue blade is the important factor in the production of coronal sounds. This is not the case in Djinang lamino-postalveolars. It is the area of the tongue to the rear of the blade (the front of the dorsal region) which is the significant lower articulator in the case of the lamino-postalveolars. For such sounds, the blade is frequently not in contact with the upper articulator, in fact, it is often in contact with the lower teeth while the primary stricture is in the postalveolar position.

Secondly, the class of non-coronal consonants in Djinang would be comprised of the labials, velars, and glides (and perhaps the other lamino-postalveolars also, if the definition of coronal sounds given by Chomsky and Halle is closely adhered to). No morphophonemic process or structural constraint so far discovered requires the delimitation of such a class of sounds (or classes of sounds, allowing for the inclusion of the other lamino-postalveolars). In section 6. it will be shown that a better grouping of sounds would be to combine labials and velars,[17] and separate /y/ (together with the other lamino-postalveolars) from the velars by the same feature.

For the reasons just given, the feature 'peripheral' is used in this paper. Its main advantages are that it gives groupings of sounds which are similar (though not identical) to the grouping of sounds defined by the feature 'coronal' (with opposite value) without the necessity of specifying the posture of the tongue. And also, that it combines the labials with the velars while separating the velars from the lamino-postalveolars (including the glide /y/).

Others have used the feature 'peripheral' in describing Australian languages (McKay 1975; Wood 1977; Sharpe 1972:14; Crowley 1976:25), presumably for the same or similar reasons to those that I have given for Djinang.

The feature 'distributed' was set up (Chomsky and Halle 1968:312) to handle retroflexion, and also apical versus non-apical articulation of consonants. This is a feature of considerable importance in Djinang, and in other Australian languages (Wood 1977; Huttar and Kirton 1978; Huttar 1976). It is defined in the following manner:

> Distributed sounds are produced with a constriction that extends for a considerable distance along the direction of the air flow; nondistributed sounds are produced with a constriction that extends only for a short distance in this direction.
> (Chomsky and Halle 1968:312)

In order to be able to specify values of this feature for vowels, it is necessary to slightly modify the definition given above for 'non-distributed' so that it reads as follows:

> non-distributed sounds are produced without a constriction that extends for a considerable distance along the direction of the air flow. Hence vowels are [-distributed].

It is of interest to consider the groupings of sounds that are obtained using the features in Table 2. Chart 6 is a restatement of the consonant chart (Chart 1) in terms of distinctive features.

CHART 6: CONSONANT CONTRASTS

		+periph		-periph			
		+dist		+dist		-dist	
		+ant	-ant	+ant	-ant	+ant	-ant
-son	-vce	p	k		ch	t	rt
	+vce	b	g		j	d	rd
+son	+nas	m	ng		ny	n	rn
	+lat					l	rl
	-syll -nas -lat	w			y	rr	r

Some of the systematic gaps in Chart 6 are of interest. Gupapuyngu, in the same group of languages as Djinang and spoken by a considerable portion of Djinang speakers, has an interdental (i.e. lamino-alveolar) order of sounds (orthographically th, dh, and nh). This order is non-peripheral, distributed and anterior, which fills the holes in the obstruent and nasal sections of the chart. The morphophonemic data for Djinang velars (k, g, and ng) has resulted in them being specified as [+distributed], and the reasons for doing so will be made clear in section 6.

In Chart 6, consider the class of non-distributed sounds (the apico-alveolars and apico-postalveolars). The claim that the apico-alveolars are not differentiated from the apico-postalveolars by the feature 'distributed', but rather by the feature 'anterior', is worth some consideration here. It might seem that the apico-alveolars should be [+distributed] and the apico-postalveolars [-distributed], due to the fact that the apico-postalveolars are apical, while the apico-alveolars are sometimes articulated with the tongue blade as well as the tip.

The apico-alveolars are not [+distributed], which can be shown by observing how the Gupapuyngu sound system is modified by Djinang speakers when the latter borrow Gupapuyngu words. Since Djinang has no interdental order, Djinang speakers must substitute a 'phonologically close' equivalent for a Gupapuyngu interdental.

What is observed is that Gupapuyngu interdentals become Djinang lamino-postalveolars, rather than apico-alveolars. With respect to their points of articulation, the lamino-postalveolars are more 'distant' from the interdentals than are the apico-alveolars. Hence, if the alveolars are assumed to be [+distributed], as are the lamino-postalveolars, why then do the Gupapuyngu interdentals not become Djinang apico-alveolars? It must be concluded that interdentals and lamino-postalveolars share a phonological property that does not occur in apico-alveolars. And since interdentals are [+anterior] and lamino-postalveolars are [-anterior], it must be concluded that it is the feature 'distributed' which separates the apico-alveolars from the interdentals and lamino-postalveolars.

An implication of this is that Djinang speakers perceive the difference between distributed versus non-distributed sounds as more significant phonologically than differences in the point of articulation (I suspect that this is true of most Australian languages). Such a conclusion is evident because membership in the [+distributed] class of sounds is retained at the expense of a greater-than-expected change in the point of articulation, when Gupapuyngu interdentals become Djinang lamino-postalveolars. The feature 'anterior', rather than the feature 'distributed' is therefore a 'low level' feature which serves to separate apico-alveolars from apico-postalveolars.

Some examples are as follows:

Gupapuyngu	Djinang	English gloss
rarranhdharr	rarranyjarr	*'dry season'*
nhämа	nyangi	*'see, look at'*
nhina	nyiniji	*'sit, stay, be'*
nhuman	nyumigi	*'smell, be odourous'*
dha<u>l</u>wirrirri'yun	jarlwirrijigi	*'slip down'*
dhanara	janngira	*'request to go'*
dhangi'yun	jan.gichigi	*'embrace'*
ga<u>n</u>angathala	garnangarchili	*'small fresh water pool'*
ngadhakthun	nganyjarchigi	*'get into trouble'*
djalathang	chalachang	*'south, cold weather'*

Further evidence for the similarity of interdentals to lamino-palatals comes from Galpu (Wood 1977:25), another of the Yolngu[18] languages. Wood states that when certain verbal and case suffixes occur in a post vowel/liquid/semi-vowel position, lamino-postalveolar affricate and interdental stop both become the lamino-postalveolar glide /y/.

Further evidence again comes from Djinang, Galpu and Gupapuyngu, namely, that liquids occur only in the class of non-distributed (i.e. apical) sounds. This completes the discussion of the feature 'distributed'.

Lastly, to enable phonetic representations, the following rules are required after lexical insertion and before the morphophonemic rules.

(a) All non-low vowels are specified as [+high] by a rule:

$$\begin{bmatrix}\text{+syll}\\ \text{-low}\end{bmatrix} \rightarrow [\text{+high}]$$

Later rules convert high vowels in stressed syllables to [-low, -high], and may also add length as well ([+long]). The details are given in 'Djinang Phonology' (see pp.1-71 in this volume).

(b) The 'delayed release' feature is given a positive value for lamino-postalveolar non-continuants by the following rule:

$$\begin{bmatrix}\text{-periph}\\ \text{+dist}\\ \text{-cont}\end{bmatrix} \rightarrow [\text{+del rel}] \ / \ \underline{\quad\quad} \ [\text{+syll}]$$

(c) The feature 'round' is given a positive value for the phonemes /w/ and /u/ by the rule:

$$\begin{bmatrix}\text{+cont}\\ \text{-low}\\ \text{+back}\end{bmatrix} \rightarrow [\text{+round}]$$

6. CONSTRAINTS AND MORPHOPHONEMIC PROCESSES

6.1. *PRELIMINARY DISCUSSION*

Before the morphophonemic rules for each class are given, there are some important observations to be made from Charts 3, 4, and 5. In the today-past column of Chart 3 it can be seen that the final four segments of the verb[19] take the form:

(1) $\begin{bmatrix}\text{+dist}\\ \text{-cont}\\ \alpha\text{nas}\\ \alpha\text{back}\end{bmatrix} \ \text{i} \begin{bmatrix}\text{-dist}\\ \text{+son}\end{bmatrix} \text{i}$, where α = + or -

The set of sounds occurring as the first consonant of the constraint (1) is:

$$\left\{\begin{matrix}\text{p} & \text{ch} & \\ \text{b} & \text{j} & \\ & & \text{ng}\end{matrix}\right\}$$

The phonemes /m/, /k/, and /g/, are excluded from this set, while the data does not indicate whether or not the phoneme /ny/ should be included. Group 6 verb stems are assumed to be a small class having partly irregular properties, and will be excluded from consideration in the statement of rules which pertain to the today-past and also to the non-past.

Considering the today-past column of Chart 4, it is seen that an almost identical constraint obtains:

$$(2)\quad \left\{\begin{matrix}\begin{bmatrix}+\text{dist}\\ -\text{cont}\\ \alpha\text{nas}\\ \alpha\text{back}\end{bmatrix}\\ \begin{bmatrix}+\text{ant}\\ +\text{lat}\end{bmatrix}\end{matrix}\right\}\ \text{i}\ \begin{bmatrix}-\text{dist}\\ +\text{son}\end{bmatrix}\text{i},\qquad \text{where } \alpha = + \text{ or } -$$

The set of sounds occurring as the first consonant in the constraint (2) is:

$$\left\{\begin{matrix}\text{p} & & \text{ch} & \\ \text{b} & & \text{j} & \\ & \text{l} & & \text{ng}\end{matrix}\right\}$$

The phoneme /l/ is included here on the basis of one stem, /kali/ *'have, possess'*. At this stage in my knowledge of Djinang, it is not clear whether the behaviour of this stem mirrors an underlying regularity (and hence warrants inclusion in the above set of sounds), or is irregular (which is what I suspect is the case). In the latter case, constraints 1 and 2 would be identical. Henceforth I will treat this stem as irregular.

Considering the today-past column in Chart 5, there is a similar constraint to constraints 1 and 2, except that more phonemes may occur as the first consonant of the constraint than for constraints 1 and 2. In this case the constraint is:

$$(3)\quad \left\{\begin{matrix}[-\text{cont}]\\ [+\text{lat}]\end{matrix}\right\}\text{i}\ \begin{bmatrix}-\text{dist}\\ +\text{son}\end{bmatrix}\text{i}$$

where the rhotics (/rr/ and /r/[20]) may not occur in the first consonant position in constraint 3. In fact, the morphophonemic rules for the today-past category in class III verbs conspire to prevent */rrini/ being a realisation of constraint 3.

The constraints 1, 2, and 3, are the unifying factor behind the various morphophonemic rules for the today-past alternations in each verb class. When morphophonemic rules affect verbs inflected for the today-past, the morphophonemic rules conspire to ensure that a constraint similar to (1) is satisfied, irrespective of the verb class involved. The constraint which is involved is a generalisation of constraints 1 and 2 as follows:

$$(4)\quad \begin{bmatrix}+\text{dist}\\ -\text{cont}\end{bmatrix}\ \text{i}\ \begin{bmatrix}-\text{dist}\\ +\text{son}\end{bmatrix}\text{i}$$

Constraint 4 allows the phoneme sequence /mini/ to occur (group 15 verbs in class III) as well as the phoneme sequences permitted by constraints 1 and 2. As examples, consider group 13 of Chart 4, and groups 15 and 16 of Chart 5.

I will now give the morphophonemic rules for each verb class. The conventions used in the statement of the rules are those of Chomsky and Halle (1968). Where some simplification of the rules can be obtained by omitting superfluous labelled bracketing, I have done so. Rules are given a number and a name. When rule order is important, the fact will be noted above the statement of the rule. The symbols vs, vsI, vsII, and vsIII, which occur as the labelling of brackets, refer to the verb stem, and verb stem classes I, II, and III, respectively. The morpheme boundary symbol, +, occurs in most rules. This reflects the fact that most of the processes to be described only occur when suffixation to a verb stem is involved. The symbol, #, denotes a word boundary. Various redundancy rules would be required for a complete treatment, but I will not deal with them in this paper.

6.2. *THE MORPHOPHONEMIC RULES*

Chart 7 is a fully specified feature matrix for all Djinang phonemes. In addition, although not stated on the chart, the phonemes are also specified as [+segment].

CHART 7: FULLY SPECIFIED FEATURE MATRIX

	p	ch	k	b	j	g	m	ny	ng	w	y	t	rt	d	rd	n	rn	l	rl	rr	r	i	u	a
syll	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	+	+
periph	+	–	+	+	–	+	+	–	+	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–
dist	+	+	+	+	+	+	+	+	+	+	+	–	–	–	–	–	–	–	–	–	–	–	–	–
ant	+	–	–	+	–	–	+	–	–	+	–	+	–	+	–	+	–	+	–	+	–	–	–	–
son	–	–	–	–	–	–	+	+	+	+	+	–	–	–	–	+	+	+	+	+	+	+	+	+
cont	–	–	–	–	–	–	–	–	–	+	+	–	–	–	–	–	–	+	+	+	+	+	+	+
nas	–	–	–	–	–	–	+	+	+	–	–	–	–	–	–	+	+	–	–	–	–	–	–	–
lat	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	+	–	–	–	–	–
back	–	–	+	–	–	+	–	–	+	+	–	–	–	–	–	–	–	–	–	–	–	–	+	+
high	–	+	+	–	+	+	–	+	+	+	+	–	–	–	–	–	–	–	–	–	–	+	+	–
low	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+
voice	–	–	–	+	+	+	+	+	+	+	+	–	–	+	+	+	+	+	+	+	+	+	+	+
rnd	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	+	–
long	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
del rel	–	+	–	–	+	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

rule 1 transitiviser protection (precedes rule 2)

$$\emptyset \rightarrow \begin{bmatrix}\text{-periph}\\ \text{+dist}\\ \text{+cont}\end{bmatrix} \Big/ \begin{bmatrix}\text{+periph}\\ \text{+ant}\\ \text{+nas}\end{bmatrix} [\text{-back}] \ \_\_\ ]_{\text{vsI}} + \begin{bmatrix}\text{-syll}\\ \text{+rnd}\end{bmatrix}$$

rule 2 vowel insertion (precedes rule 3)

$$\emptyset \rightarrow \begin{bmatrix}\text{+syll}\\ \text{+high}\end{bmatrix} \Big/ [\text{+son}] \ \_\_\ ]_{\text{vsI}} + \begin{bmatrix}\text{+dist}\\ \text{+son}\end{bmatrix}$$

rule 3 vowel rounding

$$[\text{+high}] \rightarrow [\alpha\text{rnd}] \Big/ \left[\begin{bmatrix}\_\_\\ \text{+syll}\end{bmatrix}\right]_{\text{vsI}} + \begin{bmatrix}\text{+cont}\\ \alpha\text{rnd}\end{bmatrix}, \text{ where } \alpha = + \text{ or } -$$

(A redundancy rule: [+syll, +high, αrnd] → [αback], where α = + or -, determines whether the output of rule 3 is /i/ or /u/.)[21]

rule 4 i-deletion (precedes rule 5)

$$[\text{-back}] \rightarrow \emptyset \Big/ \begin{bmatrix}\text{+dist}\\ \alpha\text{ant}\\ \text{-son}\\ \text{-back}\end{bmatrix} \ \_\_\ ]_{\text{vs}} + \begin{bmatrix}\text{+dist}\\ \alpha\text{ant}\\ \text{+nas}\\ \text{-back}\end{bmatrix}, \text{ where } \alpha = + \text{ or } -$$

rule 5 consonant deletion

$$[\text{-syll}] \rightarrow \emptyset \,/\, [\text{-son}] \ \_\_\ [\text{+nas}]$$

rule 6 devoicing

$$[\text{-son}] \rightarrow \begin{bmatrix}\text{-voice}\\ \text{-del rel}\end{bmatrix} \Big/ \ \_\_\ [\text{-syll}]$$

rule 7 velar softening

$$[\text{-son}] \rightarrow [\text{+son}] \Big/ \begin{bmatrix}\text{+dist}\\ \text{-cont}\end{bmatrix} [\text{+back}]]_{\text{vsI}} + \begin{bmatrix}\_\_\\ \text{+back}\\ \text{+voice}\end{bmatrix}$$

rule 8 gi-suffix deletion (precedes rule 9)

$$\begin{bmatrix}\text{-son}\\ \text{+back}\\ \text{+voice}\end{bmatrix} [\text{-back}] \rightarrow \emptyset \Big/ \begin{bmatrix}\text{-son}\\ \text{+back}\\ \text{+voice}\end{bmatrix} [\text{-back}]]_{\text{vsI}} + \ \_\_\ \#$$

rule 9 gi-stem deletion

$$\begin{bmatrix}\text{-son}\\ \text{+back}\\ \text{+voice}\end{bmatrix} [\text{-back}] \rightarrow \emptyset \Big/ \ \_\_\ ]_{\text{vsI}} + \emptyset \ \#$$

rule 10 ngi-deletion

$$\begin{bmatrix}\text{+nas}\\\text{+back}\end{bmatrix}[\text{-back}] \rightarrow \emptyset \;/\; \begin{bmatrix}\text{+dist}\\\text{-son}\\\text{-back}\end{bmatrix}[\text{-back}]\Big]_{\text{vsI}} + \underline{\quad}$$

rule 11 lateral shift (precedes rules 13 and 14)

$$\begin{bmatrix}\text{+ant}\\\text{+lat}\end{bmatrix} \rightarrow \begin{bmatrix}\text{-dist}\\\text{-ant}\\\text{+nas}\end{bmatrix} \;/\; \begin{bmatrix}\text{+dist}\\\text{-cont}\\\text{-back}\end{bmatrix}[\text{+back}]\Big]_{\text{vsI}} + [\text{-syll}][\text{+syll}]\;\underline{\quad}$$

rule 12 peripheral hardening (precedes rule 13)

$$\begin{bmatrix}\text{+son}\\\text{+back}\end{bmatrix} \rightarrow \begin{bmatrix}\text{-son}\\\text{-back}\\\text{-voice}\end{bmatrix} \;/\; \begin{bmatrix}\text{+periph}\\\text{+ant}\\\text{-son}\\\text{+voice}\end{bmatrix}[\text{+back}]\Big]_{\text{vsI}} + \begin{bmatrix}\underline{\quad}\\\text{+periph}\\\text{-cont}\end{bmatrix}$$

rule 13 labial rounding

$$[\text{-son}] \rightarrow [\text{+rnd}] \;/\; [\text{+seg}]\begin{bmatrix}\underline{\quad}\\\text{+periph}\\\text{+ant}\\\text{+voice}\end{bmatrix}[\text{+back}] + [\text{-son}]$$

(A redundancy rule, [-syll, +rnd] → [+son], is also required since there are no labialised obstruents in Djinang.)

rule 14 stem unrounding

$$[\text{-low}] \rightarrow [\text{-rnd}] \;/\; \#\begin{bmatrix}\text{+periph}\\\text{+ant}\\\text{-son}\end{bmatrix}\underline{\quad}\Big]_{\text{vsI}} + \begin{bmatrix}\text{+periph}\\\text{+ant}\\\text{-son}\\\text{-voice}\end{bmatrix}$$

rule 15 ji-deletion (precedes rule 17)

$$\begin{bmatrix}\text{-periph}\\\text{+dist}\\\text{-son}\\\text{+voice}\end{bmatrix}[\text{-back}] \rightarrow \emptyset \;/\; \left\{\begin{array}{l}\begin{bmatrix}\text{+dist}\\\text{+ant}\\\text{-son}\end{bmatrix}[\text{-back}]\\ [\text{+lat}]([\text{-back}])\end{array}\right\}\Big]_{\text{vsII}} + \underline{\quad}$$

rule 16 rr-deletion

$$\begin{bmatrix}\text{-dist}\\\text{+ant}\\\text{+cont}\\\text{-lat}\end{bmatrix} \rightarrow \emptyset \;/\; \begin{bmatrix}\text{+dist}\\\text{-cont}\\\text{-back}\end{bmatrix}[\text{-back}]\;\underline{\quad}\Big]_{\text{vsII}} + \begin{bmatrix}\text{-son}\\\text{+back}\\\text{+voice}\end{bmatrix}$$

rule 17 consonant deletion before apical sonorants

$$[\text{-syll}] \rightarrow \emptyset \;/\; \underline{\quad}\begin{bmatrix}\text{-syll}\\\text{-dist}\\\text{+son}\end{bmatrix}$$

rule 18 rri-insertion

$$\emptyset \rightarrow \begin{bmatrix}\text{-dist}\\ \text{+ant}\\ \text{+cont}\\ \text{-lat}\end{bmatrix} [\text{-back}] \Big/ \begin{bmatrix}\text{-periph}\\ \text{+dist}\\ \text{-son}\end{bmatrix} [\text{-back}] \Big[_{\text{y-pst}} + \_\_\_ \ \#$$

rule 19 vowel change (precedes rules 20 and 21)

$$[\text{+syll}] \rightarrow [\text{+low}] \Big/ \# \begin{bmatrix}\text{+dist}\\ \text{-cont}\end{bmatrix} \begin{bmatrix}\_\_\_\\ \text{-back}\end{bmatrix} \begin{bmatrix}\text{-dist}\\ \text{+ant}\\ \text{+cont}\\ \text{-lat}\end{bmatrix} [\text{-back}] \Big]_{\text{vsIII}} + \begin{Bmatrix}\emptyset\\ [\text{+nas}][\text{-back}]\end{Bmatrix} \#$$

rule 20 rri-deletion

$$\begin{bmatrix}\text{-dist}\\ \text{+ant}\\ \text{+cont}\\ \text{-lat}\end{bmatrix} [\text{-back}] \rightarrow \emptyset \Big/ \begin{bmatrix}\text{+dist}\\ \text{-cont}\end{bmatrix} [\text{-back}] \ \_\_\_ \Big]_{\text{vsIII}} + \begin{bmatrix}\text{-dist}\\ \text{+nas}\end{bmatrix}$$

rule 21 nyi-insertion

$$\emptyset \rightarrow \begin{bmatrix}\text{-periph}\\ \text{+dist}\\ \text{+nas}\end{bmatrix} [\text{-back}] \Big/ \begin{bmatrix}\text{-syll}\\ \alpha\text{dist}\end{bmatrix} [\alpha\text{back}] \begin{bmatrix}\text{-dist}\\ \text{+ant}\\ \text{+cont}\\ \text{-lat}\end{bmatrix} [\text{-back}] \Big]_{\text{vsIII}} + \_\_\_ \begin{bmatrix}\text{-dist}\\ \text{+nas}\end{bmatrix}$$

where α = + or -

6.3. *DISCUSSION OF THE RULES*

Rules 1 through 14 deal with the class I alternations, 15 through 17 with the class II alternations, and 18 through 21 with the class III alternations. Rules 4, 5, and 6, apply to both class I and class III. In the discussion to follow, most rules will be partly or wholly restated in terms of the orthographic symbols representing phonemes, and natural classes of sounds will be shown in braces.[22] The symbols C and V refer to consonants and vowels, respectively. The discussion is based on the information shown in Charts 3, 4, and 5, together with the rules presented in section 6.2.

6.3.1. Class I Verbs

rule 1 transitiviser protection (precedes rule 2)

$$\emptyset \rightarrow \begin{bmatrix}\text{-periph}\\ \text{+dist}\\ \text{+cont}\end{bmatrix} \Big/ \begin{bmatrix}\text{+periph}\\ \text{+ant}\\ \text{+nas}\end{bmatrix} [\text{-back}] \ \_\_\_ \Big]_{\text{vsI}} + \begin{bmatrix}\text{-syll}\\ \text{+rnd}\end{bmatrix}$$

$$\emptyset \rightarrow \text{y} \ / \ \text{mi} \ \_\_\_ \Big]_{\text{vsI}} + \text{w}$$

rule 2 vowel insertion (precedes rule 3)

$$\emptyset \rightarrow \begin{bmatrix} +\text{syll} \\ +\text{high} \end{bmatrix} \Big/ [+\text{son}] \;\underline{\quad\quad}\,\Big]_{\text{vsI}} + \begin{bmatrix} +\text{dist} \\ +\text{son} \end{bmatrix}$$

$$\emptyset \rightarrow \begin{Bmatrix} \text{i} \\ \text{u} \end{Bmatrix} \Big/ [+\text{son}] \;\underline{\quad\quad}\,\Big]_{\text{vsI}} + \begin{Bmatrix} \text{m} & \text{w} \\ \text{ny} & \\ \text{ng} & \end{Bmatrix}$$

rule 3 vowel rounding

$$[+\text{high}] \rightarrow [\alpha\text{rnd}] \Big/ \left[\begin{bmatrix} \underline{\quad\quad} \\ +\text{syll} \end{bmatrix}\right]_{\text{vsI}} + \begin{bmatrix} +\text{cont} \\ \alpha\text{rnd} \end{bmatrix}, \text{ where } \alpha = + \text{ or } -$$

$$\text{i} \rightarrow \text{u} \Big/ \underline{\quad\quad}\,\Big]_{\text{vsI}} + \text{w}$$

Rules 1, 2, and 3, deal with the imperative, and include the vowel insertions for group 3 stems. Preceding the imperative suffix, a stem final /i/ vowel changes to /u/; but after a stem final transitiviser morpheme, /mi/, the glide /y/ is inserted to prevent rule 3 from altering the transitiviser morpheme.

rule 4 i-deletion (precedes rule 5)

$$[-\text{back}] \rightarrow \emptyset \Big/ \begin{bmatrix} +\text{dist} \\ \alpha\text{ant} \\ -\text{son} \\ -\text{back} \end{bmatrix} \underline{\quad\quad}\,\Big]_{\text{vs}} + \begin{bmatrix} +\text{dist} \\ \alpha\text{ant} \\ +\text{nas} \\ -\text{back} \end{bmatrix}, \text{ where } \alpha = + \text{ or } -$$

$$\text{i} \rightarrow \emptyset \Big/ \begin{bmatrix} \{\text{p} & \text{b}\} \\ \{\text{ch} & \text{j}\} \end{bmatrix} \underline{\quad\quad}\,\Big]_{\text{vs}} + \begin{bmatrix} \text{m} \\ \text{ny} \end{bmatrix}$$ [23]

rule 5 consonant deletion

$$[-\text{syll}] \rightarrow \emptyset \,/\, [-\text{son}] \;\underline{\quad\quad}\; [+\text{nas}]$$

$$\text{C} \rightarrow \emptyset \,/\, \text{stops} \;\underline{\quad\quad}\; \text{nasals}$$

rule 6 devoicing

$$[-\text{son}] \rightarrow \begin{bmatrix} -\text{voice} \\ -\text{del rel} \end{bmatrix} \Big/ \underline{\quad\quad}\; [-\text{syll}]$$

$$\text{stops} \rightarrow \begin{bmatrix} -\text{voice} \\ -\text{del rel} \end{bmatrix} \Big/ \underline{\quad\quad}\; \text{C}$$

Rules 4, 5, and 6, involve the today past continuous and today past irrealis categories for group 5 verb stems, and the yesterday past category for group 4 verb stems. When an obstruent (i.e. a stop) is followed by /i/, and then by a suffix beginning with a nasal which is homorganic to the preceding obstruent, the /i/ vowel is deleted (rule 4). Also, when the outcome of this rule results in an obstruent - obstruent cluster preceding the nasal, the second obstruent of the cluster is deleted. Rule 5 has been generalised to apply to any consonant because it thereby captures a more general sequential segment constraint. Finally, lamino-postalveolar obstruents (rule 6) do not have a delayed release (in fact, they are unreleased) when followed by a consonant; while voiced obstruents become voiceless under the same conditions. These three rules apply equally well to group 17 verb stems in class III.

rule 7 velar softening

$$[-\text{son}] \rightarrow [+\text{son}] \Big/ \begin{bmatrix}+\text{dist}\\-\text{cont}\end{bmatrix} [+\text{back}]\Big]_{\text{vsI}} + \begin{bmatrix}\_\_\_\_\\+\text{back}\\+\text{voice}\end{bmatrix}$$

$$\text{g} \rightarrow \text{ng} \Big/ \left\{\begin{matrix}\text{p} & \text{ch} & \text{k}\\ \text{b} & \text{j} & \text{g}\\ & \text{ny} & \end{matrix}\right\}\left\{\begin{matrix}\text{u}\\ \text{a}\end{matrix}\right\}\Big]_{\text{vsI}} + \_\_\_\_$$

rule 8 gi-suffix deletion (precedes rule 9)

$$\begin{bmatrix}-\text{son}\\+\text{back}\\+\text{voice}\end{bmatrix} [-\text{back}] \rightarrow \emptyset \Big/ \begin{bmatrix}-\text{son}\\+\text{back}\\+\text{voice}\end{bmatrix} [-\text{back}]\Big]_{\text{vsI}} + \_\_\_\_ \#$$

$$\text{gi} \rightarrow \emptyset \Big/ \text{gi}\Big]_{\text{vsI}} + \_\_\_\_ \#$$

rule 9 gi-stem deletion

$$\begin{bmatrix}-\text{son}\\+\text{back}\\+\text{voice}\end{bmatrix} [-\text{back}] \rightarrow \emptyset \Big/ \_\_\_\_\Big]_{\text{vsI}} + \emptyset \ \#$$

$$\text{gi} \rightarrow \emptyset \Big/ \_\_\_\_\Big]_{\text{vsI}} + \emptyset \ \#$$

Rules 7, 8, and 9, handle the alternations in the non-past category, bearing in mind that the zero allomorph in group 6 is not assumed to be phonologically conditioned. The alternation /g/ → /ng/ in the suffix, for groups 2, 7, and 8, is sensitive to the consonant in the preceding syllable, as well as to the vowel. Either one of these is not a sufficient conditioning factor by itself, as can be seen from groups 1, 4, and 5. Rules 8 and 9 handle the deletions required by footnote 10.

rule 10 ngi-deletion

$$\begin{bmatrix}+\text{nas}\\+\text{back}\end{bmatrix} [-\text{back}] \rightarrow \emptyset \Big/ \begin{bmatrix}+\text{dist}\\-\text{son}\\-\text{back}\end{bmatrix} [-\text{back}]\Big]_{\text{vsI}} + \_\_\_\_$$

$$\text{ngi} \rightarrow \emptyset \Big/ \left\{\begin{matrix}\text{p} & \text{ch}\\ \text{b} & \text{j}\end{matrix}\right\}\text{i}\Big]_{\text{vsI}} + \_\_\_\_$$

rule 11 **lateral shift** (precedes rules 13 and 14)

$$\begin{bmatrix}+\text{ant}\\+\text{lat}\end{bmatrix} \rightarrow \begin{bmatrix}-\text{dist}\\-\text{ant}\\+\text{nas}\end{bmatrix} \Big/ \begin{bmatrix}+\text{dist}\\-\text{cont}\\-\text{back}\end{bmatrix} [+\text{back}]\Big]_{\text{vsI}} + [-\text{syll}][+\text{syll}] \ \_\_\_$$

$$\text{l} \rightarrow \text{rn} \Big/ \left\{\begin{matrix}\text{b}\\\text{ny}\end{matrix}\right\}\left\{\begin{matrix}\text{u}\\\text{a}\end{matrix}\right\}\Big]_{\text{vsI}} + \text{CV} \ \_\_\_$$

rule 12 **peripheral hardening** (precedes rule 13)

$$\begin{bmatrix}+\text{son}\\+\text{back}\end{bmatrix} \rightarrow \begin{bmatrix}-\text{son}\\-\text{back}\\-\text{voice}\end{bmatrix} \Big/ \begin{bmatrix}+\text{periph}\\+\text{ant}\\-\text{son}\\+\text{voice}\end{bmatrix} [+\text{back}]\Big]_{\text{vsI}} + \begin{bmatrix}\_\_\_\\+\text{periph}\\-\text{cont}\end{bmatrix}$$

$$\text{ng} \rightarrow \text{p} \Big/ \text{bu}\Big]_{\text{vsI}} + \ \_\_\_$$

rule 13 **labial rounding**

$$[-\text{son}] \rightarrow [+\text{rnd}] \Big/ [+\text{seg}] \begin{bmatrix}\_\_\_\\+\text{periph}\\+\text{ant}\\+\text{voice}\end{bmatrix} [+\text{back}] + [-\text{son}]$$

$$\text{b} \rightarrow \text{w} \Big/ \left\{\begin{matrix}\text{C}\\\text{V}\end{matrix}\right\} \ \_\_\_ \ \left\{\begin{matrix}\text{a}\\\text{u}\end{matrix}\right\} + \left\{\begin{matrix}\text{p}\\\text{rd}\\\text{ch}\end{matrix}\right\}$$

rule 14 **stem unrounding**

$$[-\text{low}] \rightarrow [-\text{rnd}] \Big/ \# \begin{bmatrix}+\text{periph}\\+\text{ant}\\-\text{son}\end{bmatrix} \ \_\_\_\Big]_{\text{vsI}} + \begin{bmatrix}+\text{periph}\\+\text{ant}\\-\text{son}\\-\text{voice}\end{bmatrix}$$

$$\text{u} \rightarrow \text{i} \Big/ \#\text{b} \ \_\_\_\Big]_{\text{vsI}} + \text{p}$$

Rules 10 through 14 are required for the alternations within the today past category. Rule 11 changes the lateral /l/ into the retroflex nasal /rn/. The rule assumes that the conditioning factor is the final syllable of the verb stem, with the intervening /ngi/ syllable not having any conditioning effect. It might appear that to handle the presence of /ngi/ in the today past as an insertion might be preferable, since then the conditioning factor in rule 11 would become the preceding syllable. However, this change would alter rule 10 unacceptably. Consider rule 10 as it stands. The conditioning factor in it is the presence of a stem final syllable having the form of a non-back distributed obstruent followed by /i/. This is clearly in agreement with constraint 1 mentioned in the preliminary discussion, section 6.1. Changing rule 10 to a rule for insertion of /ngi/ gives rule 10':

$$\emptyset \rightarrow ngi \Big/ \left\{ \begin{array}{l} \left\{\begin{array}{c} u \\ a \end{array}\right\} \\ C \\ \left\{\begin{array}{c} k \\ g \\ m \end{array}\right\} i \\ \left[\begin{array}{l} -syll \\ -dist \end{array}\right] V \end{array} \right\} \Big]_{vsI} \left[\begin{array}{l} + \_\_\_ \\ t\text{-}pst \end{array}\right]$$

The environments specified by rule 10' are all the environments occurring in the data that do not conform to the shape of constraint 1. Clearly, this fails to express a significant generalisation and is therefore unacceptable.

Rules 12, 13, and 14, deal with the today past alternations for group 7 verb stems. Thus /ng/ hardens to become /p/ (rule 12), and then the outputs of rule 12 undergo either rule 13, which rounds /b/ to become /w/, or rule 14, which unrounds /u/ occurring in 'short' (i.e. one syllable) stems. Rule 13 applies not only to group 7 stems (group 7 stems are of form #CVCbu#, or #bu#), but within verb stems (and possibly elsewhere) also. An example of the latter case is the verb rdabachigi *'look back'*, from which is derived the verb rdabardabachigi *'look back repeatedly'*. In fast speech, the latter verb is often realised as rdawardawachigi. Rule 13 has been generalised (i.e. it has fewer features) to account for this change, as well as for the changes in group 7 stems outlined in Chart 3.

The change /b/ → /w/ does not occur with the stem #bu#, and this change is blocked by including the feature [+segment] in the environment of rule 13. If this change were not blocked for the stem #bu#, then the principal phonetic identificational cue for that stem would be obscured. By this I am assuming that the language will not tolerate the application of a morphophonemic rule that seriously modifies the stem. This helps to explain not just the behaviour for the stem #bu#, but also the behaviour in the today past category for group 16 verb stems in class III. In the latter case, rule 19 changes the first stem vowel (these stems are disyllabic) in order to block a later rule (rule 20) which would otherwise delete the second syllable of the stem and thus obscure some of the identificational cues of that stem. Nevertheless, the stem #bu# must be modified because when inflected for today past it is homophonous with bupirni *'mosquito'*. The only reasonable strategy is to change the stem vowel; hence rule 14 unrounds the stem vowel /u/ in order to produce the vowel /i/, which is the unmarked vowel (phonologically speaking) in Djinang.

6.3.2. Class II Verbs

rule 15 ji-deletion (precedes rule 17)

$$\begin{bmatrix}\text{-periph}\\ \text{+dist}\\ \text{-son}\\ \text{+voice}\end{bmatrix} [\text{-back}] \rightarrow \emptyset \Big/ \left\{ \begin{matrix} \begin{bmatrix}\text{+dist}\\ \text{+ant}\\ \text{-son}\end{bmatrix}[\text{-back}] \\ [\text{+lat}]([\text{-back}]) \end{matrix}\right\} \Big]_{vsII} + \_\_\_$$

$$\text{ji} \rightarrow \emptyset \Big/ \left\{ \begin{matrix} \begin{Bmatrix}\text{p}\\ \text{b}\end{Bmatrix}\text{i} \\ \text{l}\ \ (\text{i}) \end{matrix}\right\} \Big]_{vsII} + \_\_\_$$

rule 16 rr-deletion

$$\begin{bmatrix}\text{-dist}\\ \text{+ant}\\ \text{+cont}\\ \text{-lat}\end{bmatrix} \rightarrow \emptyset \Big/ \begin{bmatrix}\text{+dist}\\ \text{-cont}\\ \text{-back}\end{bmatrix} [\text{-back}] \_\_\_ \Big]_{vsII} + \begin{bmatrix}\text{-son}\\ \text{+back}\\ \text{+voice}\end{bmatrix}$$

$$\text{rr} \rightarrow \emptyset \Big/ \begin{Bmatrix}\text{b} & \text{j}\\ \text{m} & \end{Bmatrix}\text{i}\ \_\_\_ \Big]_{vsII} + \text{g}$$

rule 17 consonant deletion before apical sonorants

$$[\text{-syll}] \rightarrow \emptyset \Big/ \_\_\_ \begin{bmatrix}\text{-syll}\\ \text{-dist}\\ \text{+son}\end{bmatrix}$$

$$\begin{Bmatrix}\text{l}\\ \text{rr}\end{Bmatrix} \rightarrow \emptyset \Big/ \_\_\_ \begin{Bmatrix}\text{n} & \text{rn}\\ \text{rr} & \end{Bmatrix}$$

Various analyses were considered for this class. There are problems because, as shown on Chart 4, group 13 stems are cited with /l/ occurring stem finally, while stems in groups 9 and 11 are cited with /rr/ occurring stem finally. It is not possible to handle the presence of stem final /l/ and /rr/, as phonologically governed insertions.

To see this, consider groups 9, 12, and 13. The environment, /ji___#, is required as part of an /l/ insertion rule and also as part of an /rr/ insertion rule (groups 9 and 13). In addition, /rr/ is inserted in group 9 in the environment, /bi___#, but fails to be inserted in group 12 in the same environment.

Another problem is whether the initial syllable, /ji/, of the today past suffix is a part of the suffix as shown in Chart 4, or rather the result of an insertion rule. Consider the following analyses:

(i) Treat /ji/ as part of the today past suffix; with /l/ and /rr/ both occurring stem-finally at the systematic phonemic level.

(ii) Treat /ji/ in the today past category, and the 'stem final' occurrence of /rr/, as the result of insertion rules. Here, /l/ occurs stem finally at the systematic phonemic level.

Analysis (ii) requires the following:

(a) Group 10 stems undergo insertion of /rr/, along with groups 9 and 11 stems, to allow insertion of /ji/ for the today past category to be governed by the occurrence of a stem final consonant.

(b) The stem final /rr/ in group 10 must be deleted after /ji/ insertion has occurred, but not so with groups 9 and 11.

(c) To make the rules 'work', one lexical item in group 9 has to be treated as containing a stem final /rr/ at the systematic phonemic level, namely, the stem /balibirr/ *'extinguish'*. Otherwise, it would not be possible to give a reasonable explanation for the insertion of /ji/ before the today past suffix, -ni, in group 9, when such insertion is lacking in group 12.

(d) Group 13 behaviour requires a deletion rule to delete occurrences of stem final /l/ in all categories except the non-past. The rule is in agreement with constraints on consonant clusters however (see Appendix 1).

(e) Five rules are needed for class II stems.

Comparing analysis (ii) with analysis (i), the latter has the following advantages:

(a') It is not necessary to assume that /rr/ occurs stem finally for stems in group 10. Thus avoidance of homophony with the today past category is achieved by the different shape of the today past suffix.

(b') The stem /balibirr/ ceases to be an 'exception' in group 9, since all verb stems in this group now have stem final /rr/ at the systematic phonemic level.

(c') Although more deletions are required for analysis (i), the rules involved express more of the general constraints on consonant clusters (in particular, that clusters of two apical sonorants are illegal).

(d') Only three rules are required, instead of five.

(e') There is a formal similarity between rule 15 for deleting /ji/ from the today past suffix in class II, and rule 10 for deleting /ngi/ from the today past suffix in class I. This similarity would be obscured if analysis (ii) were adopted.

For these reasons I prefer analysis (i), which is embodied in rules 15, 16, and 17.

Rule 17 expresses the fact that consonants may not occur preceding apical sonorant consonants (see Appendix 1). Rule 16, namely,

$$\text{rr} \rightarrow \emptyset \;/\; \left\{\begin{matrix}\text{b} & \text{j}\\ \text{m} & \end{matrix}\right\}\text{i} \;\_\_\_\; \Big]_{\text{vsII}} + \text{g}$$

is designed to delete stem final /rr/ in the non-past category for group 9 stems. This rule indirectly expresses the fact that a */gigi/ sequence occurring word finally and across a verb stem-verb suffix boundary[24] is unacceptable. For class I stems, where this sequence potentially arises in group 2, the sequence is avoided by the application of rules 8 and 9. However, for class II stems, failure to delete stem final /rr/ in group 11 when non-past suffixation occurs accomplishes the avoidance of a */gigi/ sequence[25] across the stem-suffix boundary.

6.3.3. Class III Verbs

rule 18 rri-insertion

$$\emptyset \rightarrow \begin{bmatrix}-\text{dist}\\ +\text{ant}\\ +\text{cont}\\ -\text{lat}\end{bmatrix} [-\text{back}] \;/\; \begin{bmatrix}-\text{periph}\\ +\text{dist}\\ -\text{son}\end{bmatrix} [-\text{back}] \Big[_{\text{y-pst}} + \;\_\_\_\; \#$$

$$\emptyset \rightarrow \text{rri} \;/\; \left\{\begin{matrix}\text{ch}\\ \text{j}\end{matrix}\right\}\text{i} \;\Big[_{\text{y-pst}} + \;\_\_\_\; \#$$

In the yesterday past category, if the allomorph -rri were not suffixed by rule 18 to stems in group 17, then it would be very easy to confuse yesterday past inflection with non-past inflection for verb stems in this group. Thus rule 18 performs a disambiguation function.

The alternations for group 17 stems in the today past irrealis and today past continuous categories have already been handled by rules 4, 5, and 6, which apply to verb classes I and III, and vacuously to verb class II. At this stage it appears that these alternations occur in order to obtain natural rhythmic patterns in an utterance. Rhythmic patterns are dealt with in 'Djinang Phonology' (see pp.1-71 in this volume).

rule 19 vowel change (precedes rules 20 and 21)

$$[+\text{syll}] \rightarrow [+\text{low}] \;/\; \# \begin{bmatrix}+\text{dist}\\ -\text{cont}\end{bmatrix} \begin{bmatrix}\_\_\_\\ -\text{back}\end{bmatrix} \begin{bmatrix}-\text{dist}\\ +\text{ant}\\ +\text{cont}\\ -\text{lat}\end{bmatrix} [-\text{back}] \Big]_{\text{vsIII}} + \left\{\begin{matrix}\emptyset\\ [+\text{nas}][-\text{back}]\end{matrix}\right\} \#$$

$$\text{i} \rightarrow \text{a} \;/\; \# \left\{\begin{matrix}\text{j}\\ \text{ng}\end{matrix}\right\} \;\_\_\_\; \text{rri} \Big]_{\text{vsIII}} + \left\{\begin{matrix}\emptyset\\ \left\{\begin{matrix}\text{n}\\ \text{ny}\end{matrix}\right\}\text{i}\end{matrix}\right\} \#$$

rule 20 rri-deletion

$$\begin{bmatrix}-\text{dist}\\+\text{ant}\\+\text{cont}\\-\text{lat}\end{bmatrix}[-\text{back}] \rightarrow \emptyset \;/\; \begin{bmatrix}+\text{dist}\\-\text{cont}\end{bmatrix}[-\text{back}] \;\_\_\_\; \Big]_{\text{vsIII}} + \begin{bmatrix}-\text{dist}\\+\text{nas}\end{bmatrix}$$

$$\text{rri} \rightarrow \emptyset \;/\; \begin{Bmatrix}\text{ch} & \text{k}\\ \text{m} & \text{ng}\end{Bmatrix}\text{i} \;\_\_\_\; \Big]_{\text{vsIII}} + \text{n}$$

rule 21 nyi-insertion

$$\emptyset \rightarrow \begin{bmatrix}-\text{periph}\\+\text{dist}\\+\text{nas}\end{bmatrix}[-\text{back}] \;/\; \begin{bmatrix}-\text{syll}\\ \alpha\text{dist}\end{bmatrix}[\alpha\text{back}]\begin{bmatrix}-\text{dist}\\+\text{ant}\\+\text{cont}\\-\text{lat}\end{bmatrix}[-\text{back}]\Big]_{\text{vsIII}} + \;\_\_\_\; \begin{bmatrix}-\text{dist}\\+\text{nas}\end{bmatrix}$$

where α = + or −

$$\emptyset \rightarrow \text{nyi} \;/\; \left\{\begin{matrix}\begin{Bmatrix}\text{j}\\ \text{ng}\end{Bmatrix}\begin{Bmatrix}\text{u}\\ \text{a}\end{Bmatrix}\\ \begin{bmatrix}-\text{syll}\\-\text{dist}\end{bmatrix}\text{i}\end{matrix}\right\} \text{rri} \Big]_{\text{vsIII}} + \;\_\_\_\; \text{n}$$

Rules 19, 20, and 21, handle the alternations in the today past category. From Chart 5 it is clear, by examining groups 15 and 16, that the verb final sequence */rrini/ is illegal. This sequence is avoided by deleting the stem final syllable, /rri/, in group 15 (rule 20), whereas in group 16 a transition syllable, /nyi/, is inserted between the stem and the suffix (rule 21). To explain the significance of these rules, and rule 19 in particular, it is necessary to consider groups 15 and 16 more closely.

Group 15 stems have the form #CVC{m, ng, ch}irri#, or #CVkirri# (one example only of the latter in the data). Group 16 stems have the form #CVrri# (only two examples in the data). In the latter group, one stem is #ngurri# *'sleep, lie down'*, and the other is #jirri# *'stand up, be awake'*. When yesterday past, today past continuous, or today past suffixation occurs (see footnote 16 and Chart 5), the stem #jirri# changes to #jarri#. It is this vowel change which gives a significant clue to the conditioning factors which are in operation for the today past alternations. It appears, from the shapes of the stems in groups 15 and 16, that the length of the stem is an important factor. Also, it can be seen that the changes which occur produce verb final sequences of the form:

(4) $\begin{bmatrix}+\text{dist}\\-\text{cont}\end{bmatrix}\text{i}\begin{bmatrix}-\text{dist}\\+\text{son}\end{bmatrix}\text{i}$,

which was cited in section 6.1. as a generalisation of the word level structural constraints applying to the today past category in class I and class II verbs. Although constraint 4 does not apply throughout class III verbs for the today past alternations (see group 14, Chart 5), it would seem that it does govern the form of phonological processes when they do occur. Thus rule 19 contains, among other things, the stem length conditioning factor; while rules 20 and 21 contain elements of the word level constraint 4.

Rule 20 asserts that when constraint 4 can be satisfied by deletion of /rri/, deletion occurs irrespective of the length of the stem. Rule 21 states that /nyi/ is inserted in all cases where deletion of /rri/ would not satisfy the constraint 4, irrespective of the length of the stem. Rule 19 asserts that if rule 20 were permitted to apply to short stems, then deletion of /rri/ would result in the loss of important phonetic identificational cues. In such cases, the first stem vowel, /i/, must change to /a/ to ensure the subsequent application of rule 21 rather than rule 20 (i.e. insert /nyi/ rather than delete /rri/). This is further evidence that the claim, in section 6.3.1., that 'the language will not tolerate the application of a morphophonemic rule that seriously modifies the stem', is a reasonable one. Alternatively, if this claim is taken as self-validating, then it lends support to the rules for alternations involving 'short' stems in the today past category for classes I and III verbs (see the discussion of rule 14 in section 6.3.1.).

These rules are assumed to constitute the best explanation for the today past alternations in class III. In addition, it should be noted that rule 19 explicitly states that the vowel change occurs only when the suffix is a zero morpheme or a monosyllable. I have no explanation for why this should be so.

Lastly, rule 21 predicts what should happen to a stem of form #[-syll, -dist]irri# when today past suffixation occurs. When α = –, in rule 21, the rule is:

$$\emptyset \rightarrow \text{nyi} \;/\; \begin{bmatrix}\text{-syll}\\ \text{-dist}\end{bmatrix} \text{irri} \Big]_{\text{vsIII}} + \_\_\_ \;\text{n}$$

Although no stem having this form has yet been observed, there is no structural constraint prohibiting the occurrence of such a stem.

This prediction of the behaviour of such a stem is based on constraint 4. Rule 20 implies that rri-deletion occurs only when the output will satisfy constraint 4, and nyi-insertion (rule 21) applies otherwise. There are two ways this 'otherwise' condition can be met. One way is for a stem of form #[+dist][+back]rri#. Two such stems occur in the data and are handled by rule 21 with α = +. The other way is for a stem of form #[-syll, -dist]irri#, and such a case (should it ever occur) is handled by rule 21 with α = –.

7. CONCLUSION

The features 'distributed' and 'peripheral' are not only important for contrastive purposes, but are also very significant as governing factors in morphophonemic processes and in defining natural classes of sounds which occur in those processes and in word level constraints on segment sequences. This conclusion implies that areas of the phonology other than the morphophonemics should also utilise these features as governing factors in processes, for defining natural classes of sounds, and in sequential segmental constraints. Hence, this conclusion constitutes a claim which is open to verification (or refutation) by a study of further aspects of Djinang phonology. This point is taken up in more detail in 'Djinang Phonology' (see pp.1-71 in this volume).

Concerning constraints and rule conspiracies, consider the following:

> Although some constraints seem to refer to the morpheme as it appears in the lexicon, other constraints refer to the structure that exists after words have been formed. These constraints refer either to the word or to the syllables that comprise the word. (Kenstowicz and Kisseberth 1977:149)

> We have seen in our discussion of conspracies, however, that it sometimes makes sense to talk about a constraint and the processes that implement that constraint. It might well be the case that there are static constraints that must be formulated at the morpheme level, and that in addition there are processes that work to enforce these constraints in the course of derivations. (Kenstowicz and Kisseberth 1977:154)

The rules presented in this paper support these claims, given a morpheme-based lexicon.[26]

Lastly, by means of the rules and constraints described in this paper, Djinang can be analysed as having just three major verb classes.

NOTES

1. Sometimes spelt as Yandjinang or Djinhang in the literature.

2. On maps, the Glyde river is often shown as the Goyder. Actually, the Goyder flows into the Arafura swamp, and the Glyde flows from the swamp to the sea.

3. Actually, the suffixes code tense, aspect, and mood information.

4. Except for a small class of verbs which take no inflection at all, and very often occur with an inflected verb having the same meaning.

5. The suffix -ban has the meaning *'now'* when the time reference is present time; for past or future times it has the meaning *'then'* or *'at that time'*.

6. The term 'irrealis' was suggested by A. Capell, in a private communication.

7. The time reference may be from one to many days in the immediate past, so long as a known specific time is being referred to.

8. These three classes will be defined in section 4.

9. After a stem final mi syllable, a transition syllable yu occurs before the suffix -wi, instead of the vowel change i# → u#.

10. There are two examples in the data, having a stem final gi syllable. This syllable is deleted from the stem and there is no suffixation in the non-past category. That is, yani and mini instead of

*yan.gingi (or *yan.gigi) and *minigingi (or *minigigi) for the non-past inflection. In addition, for today past, minali instead of *minigingili (compare group 6 verbs).

11. The phonemes /j/ or /ch/ are deleted also, if preceded by a stop.

12. By 'irregular' I mean that the behaviour for the non-past and today past categories does not appear to be determinable by reasonable phonological processes. Accordingly, I have treated this as a small group of partly irregular verbs.

13. The stems are giri *'go, do'*, and nunjirri *'run, do quickly'*.

14. Also, /b/ becomes /w/, except for the stem #bu# which gives bi-pirni instead of *wu-pirni.

15. The inflected forms of these two verbs in this group are as follows: jirriji, jarri, jarrinyi, jirriyi, jirrinyiri, jarrinyini *'stand up, be awake'*; ngurriji, ngurri, ngurrinyi, ngurriyi, ngurrinyiri, ngurrinyini *'sleep, lie down'*. The order of presentation of these verb forms is that of the left to right order of suffix categories in Chart 5.

16. When this suffix occurs, if the vowel /i/ occurs in the first syllable of the stem, that /i/ changes to /a/.

17. There are also non-verbal phenomena which indicate the importance of the peripheral class of sounds. These phenomena are more suited for inclusion in a description of Djinang phonology, and so will not be treated in this paper.

18. Yolngu, meaning *'people'*, is a word used extensively by Aboriginals in northeast Arnhem Land to refer to themselves. Murngic languages, to which group Galpu, Gupapuyngu, and Djinang belong, are often referred to as 'Yolngu' (or 'Yuulngu') languages (Voegelin and Voegelin 1977: 241).

19. In this section, by 'verb' I am referring to the word level construction of stem plus suffix, after all relevant morphophonemic rules have applied.

20. It is not clear from the data whether /r/ patterns identically to /rr/ for verbs in this class. I am presuming identical patterning on the basis of apparent identical patterning in (a) verb stem class I, and (b) consonant clusters (see Appendix 1).

21. Alternatively, linking conventions (Chomsky and Halle 1968) could be used for a redundancy of this type. I will not consider this possibility any further in this paper.

22. Only those phonemes within the natural class that actually occur in the verb data are included in the braces.

23. From Hyman (1975:119), the square bracket notation denotes co-occurrence restrictions. That is, a rule $A \rightarrow B \,/\, \begin{bmatrix} C \\ D \end{bmatrix} \underline{\quad\quad} \begin{bmatrix} E \\ F \end{bmatrix}$ is a conflation of the two rules $A \rightarrow B \,/\, C \underline{\quad\quad} E$, and $A \rightarrow B \,/\, D \underline{\quad\quad} F$.

24. It is permitted to have a /gigi/ sequence across a morpheme boundary within a stem, although I only know of one such case at the present time. It is the class III stem: gurn.gi-girn-ji (literally: *head-having*-verbaliser) which means *'cause (someone) to think'* or *'cause (someone) to consider'*.

25. It could be argued that these two different strategies for avoiding this sequence furnish further evidence that /rr/ occurs stem finally at the systematic phonemic level in group 11 at least.

26. Word level constraints and the processes which conspire to enforce them are a part of Djinang phonological structure irrespective of whether the lexicon is morpheme-based or word-based. It is not my intention to endorse all aspects of Kenstowicz and Kisseberth's (1977) theoretical position.

BIBLIOGRAPHY

CHOMSKY, N. and M. HALLE
1968 *The sound pattern of English.* New York: Harper and Row.

CROWLEY, T.M.
1976 'Phonological change in New England'. In R.M.W. Dixon, ed. *Grammatical categories in Australian languages*, 19-50. *AAS*, L22. Canberra: A.I.A.S.

HUTTAR, G.L.
1976 'Notes on Pintupi phonology'. *Talanya* 3:14-24.

HUTTAR, G.L. and J. KIRTON
1978 Contrasts in Yanyuwa consonants. Paper presented in May 1978 at the meeting of the Australian Linguistic Society at the Australian National University, Canberra.

HYMAN, L.M.
1975 *Phonology: theory and analysis.* New York: Holt, Rinehart and Winston.

KENSTOWICZ, M. and C. KISSEBERTH
1977 *Topics in phonological theory.* New York: Academic Press.

McKAY, G.R.
1975 Rembarnga: a language of central Arnhem Land. Ph.D. thesis, Australian National University, Canberra.

SHARPE, M.C.
1972 *Alawa phonology and grammar. AAS* 37, L15. Canberra: A.I.A.S.

WOOD, R.K.
1977 'Some aspects of Galpu phonology'. *Talanya* 4:24-29.

VOEGELIN, C.F. and F.M. VOEGELIN
1977 *Classification and index of the world's languages.* New York: Elsevier.

APPENDIX 1

Consonant Clusters

In the chart, the symbol 'R' implies that the only examples of such a cluster involve clusters which occur across a reduplication boundary within a stem (whether a noun or verb stem). It can be expected that further fieldwork will add entries to the chart, and that the occurrences of the symbol 'R' will be eliminated in some portions of the chart. In the cluster C_1C_2, the first consonant, C_1, is on the left side of the chart, and the second consonant, C_2, is on the top of the chart.

C_1 \ C_2			+dist												-dist										
			-son						+son						-son				+son					
			p	ch	k	b	j	g	m	ny	ng	w	y	t	rt	d	rd	n	rn	l	rl	rr	r
+dist	-son	p					+		+	+	+												
		ch	+			+	+		+	+													
		k				R	+		+		+	R					R						
	+son	m	+		+	+	+			+	+												
		ny		+	+		+	+	+														
		ng			+	+	+	+	+	+	+					R							
		w			+	+	+		+		+												
		y	+	+	+	+	+	+	+			+				R							
-dist	-son	t	+	R	R		+		+														
		rt	+	R	R		+	R	+								+						
	+son	n	+	+	+	+	+	+	+		+					+							
		rn			+	+	+	+	+	+	+	+					+						
		l	+	+	+	+	+	+	+	+	+	+	+			+							
		rl	+	+	+	+	+		+		+	+											
		rr	+	+	+	+	+	+	+		+	+	+	+									
		r	+	+	+	+	+	+	+		+	+	R		+								

The rows which represent clusters with the initial segment a voiced obstruent have been omitted because there are no such clusters permitted in the language (see rule 6, an obligatory rule which devoices obstruents which occur cluster-initially).

The following observations can be made from the chart:

(1) Clusters of form C[-dist, +son] are not permitted.

(2) Voiced obstruents may not precede another consonant.

(3) Clusters of form C[-dist, -son] are permitted only when the following conditions obtain: (i) If the first consonant is apical (i.e. [-dist]), the cluster is either a rhotic preceding a homorganic voiceless stop, or an apical non-rhotic sonorant (i.e. n, rn, l, or rl) preceding a homorganic voiced stop; (ii) Clusters of form [+dist] [-dist, -son] are not permitted except across a reduplication boundary (i.e. the reduplication boundary must be ranked with a word boundary, since phonotactic constraints break down across it).

(4) Statistically, the majority of clusters are comprised of the sequence [+son] [+periph, +dist]. Only slightly less frequent is the sequence [+son] [-periph, +dist]. In the latter sequence, the verbaliser morpheme, -ji, is very productive in the formation of clusters of this type.

APPENDIX 2
Verb Data

In this appendix a list of verbs, each inflected for the non-past category, is given. The non-past suffix is separated from the stem by a hyphen. Beside the citation form of the verb the English gloss is given. Any other comments are stated following the gloss.

In those groups of verbs which do not have a large membership (at the time of writing), all the verbs for that group are listed. When the membership in a group exceeds about 20 verbs, only a selection of the verbs in the group are given. The abbreviation 'etc.' at the end of a list indicates that the list is a sample only; while the absence of 'etc.' signals that all the known forms are listed.

When giving a sample, I have tried to list both long and short stems along with more 'average' length stems. I have also included a selection of 'complex' stems (those with several closed syllables). By so doing, I have attempted to give the reader a sufficient variety of stems so that alternative analyses to the one that I have presented may be tried.

No significance should be attached to the order in which the verbs are listed. Syllabic nasals (all syllabic nasals in Djinang are not phonemic) will be marked by the symbol ' ̩ ' below the nasal concerned.

In this appendix, 144 verbs are listed, comprising approximately 70% of the corpus on which this paper is based.

Class I group 1

rlurlurlumi-gi	*'pull off in strips'*
lapmiri-gi	*'open'*
jiti-gi	*'pull'*
muchpini-gi	*'build'*
yigili-gi	*'swim, wash'*
birru-gi	*'bring, take'*

ra-gi	*'go inside'*
warti-gi	*'swear at, make trouble'*
rindi-gi	*'cut off, tear off'*
jarlbirni-gi	*'push pieces together'*
mukmi-gi	*'stop talking'*
rdiyrdiymi-gi	*'search for head lice'*
wali-ki	*'crawl'* (irregular suffix in non-past)
etc.	

Class I group 2

buchinjirrku-ngi	*'listen'* (lit. *ear-self-give*)
raku-ngi	*'catch by a line'*
marrika-ngi	*'wait'*
yulgu-ngi	*'come, meet, arrive'*
ga-ngi	*'bring, take'*
milkurrku-ngi	*'mix'*
wayku-ngi	*'stand up, be ready to go'*
yani	*'send'* (stem: yan.gi occurs with suffixes in other categories)

Class I group 3

rarripar-gi	*'mend, sew'* (lit. *edge-spread*)
jukmarr-gi	*'spit'*
marr-gi	*'pick up, get, understand'*
bar-gi	*'rise up (fluid or tide), spread'*
jar-gi	*'cut, chop'*
rar-ki	*'roll string on thigh'* (irregular suffix in non-past)

Class I group 4

mirnrdirrbi-gi	*'eat'*
mirnibi-gi	*'close'*
gaypi-gi	*'take away from'*
gilibi-gi	*'hang up'*
rarrigaypi-gi	*'share'* (lit. *take-edge from*)
barlpi-gi	*'jab, pound, press'*
jirrilbi-gi	*'drop'*

Class I group 5

barlangawji-gi	*'flood, smother, surround'*
bardiriji-gi	*'shoot'*
mijirrji-gi	*'erase (by rubbing)'*
burrjiji-gi	*'wipe clean, wipe dry'*

wikwikji-gi	*'empty, throw away'*
gurn.gigirnji-gi	*'suggest, cause to think or consider'*
michi-gi	*'make, create'*
yirrarji-gi	*'dig for water'*
yirrachi-gi	*'scratch, shave, scrape'*
wupwupji-gi	*'blow (with the mouth)'*
nguyinyji-gi	*'sneeze'*
kurchi-gi	*'gather, pick up'*
murchi-gi	*'be sick'*
wichi-gi	*'shout'*
rduchi-gi	*'squeeze'*
wuywuychi-gi	*'shake to and fro'* (transitive)
garji-gi	*'whisper'*
kitkitji-gi	*'laugh'*
chilchi-gi	*'leak'*
dapchi-gi	*'cramp, feel pain of a wound'*
ngamamaji-gi	*'make, form'*
palpalji-gi	*'do something while balancing (e.g. climb)'*
nuchi-gi	*'urinate'*
garrayji-gi	*'be good'*
jagaji-gi	*'take care of'*
gururlji-gi	*'visit'*
chatchatji-gi	*'wake (someone) up by shaking'*
wukirriji-gi	*'write'*
pirriji-gi	*'wind up'*
manbiji-gi	*'make hard'*
wachi-gi	*'protrude'*
etc.	

Class I group 6

giri ∿ kiri	*'go, walk, do'*
nunjirri	*'run, drive, fly, do quickly'*

Class I group 7

yarlbu-ngi	*'peel'*
rarrigalbu-ngi	*'sharpen'* (lit. *edge-put*)
bu-ngi	*'hit, kill, make'*
galbu-ngi	*'put, put down'*
marnbu-ngi	*'be hard, be hot (sun)'*

Class I group 8

manya-ngi	*'find, try'*
yanya-ngi	*'request'*
nya-ngi	*'see, read, look at, consider'*

Class II group 9

jamirr-gi	*'steal'*
balibirr-gi	*'extinguish'*
gamirr-gi	*'dig'*
nyumirr-gi	*'smell, be odorous'*
ngamirr-gi	*'paint'*
warrijirr-gi	*'ignite'*
walijirr-gi	*'ask another to walk with oneself'*
rurrchimirr-gi	*'wash'*
rdirnrdimirr-gi	*'pinch'*
wirrimirr-gi	*'scrape, shave bark off a tree, sharpen'*

Note: stem final /rr/ of each stem in this group is deleted before all suffixes except today past.

Class II group 10

gachi-gi	*'hold, catch, obtain, reach destination, be grouped together'*
bachi-gi	*'cook'*
bulchi-gi	*'tell'*
rirrchi-gi	*'roast'*

Class II group 11

gilgirr-gi	*'hide'*
ngagirr-gi	*'cover'*
yagirr-gi	*'put into (a container or bag)'*

Note: stem final /rr/ of each stem in this group is deleted before all suffixes except today past and non-past.

Class II group 12

jalchibi-gi	*'lift up'*
yirrpi-gi	*'stand up, set straight, position, stop at destination (to do something)'*
kali-ki	*'possess, have, be married'* (irregular suffix in non-past)
barrpi-gi	*'rub together'*
gurrpi-gi	*'chase, follow'*
garrpi-gi	*'twist, tie'*
mildirrpi-gi	*'show, point at'*
marribi-gi	*'lose, forget'*

Class II group 13

birrinjingil-gi	*'turn over, translate'*
ngalwarchil-gi	*'rest, breathe heavily'*
jarrpinjil-gi	*'make'*
wirnijingil-gi	*'bring back, return to original position'*

Note: stem final /l/ of each stem in this group is deleted before all suffixes except non-past.

Also, the irregular verb: rani (non-pst), randinmi (y-pst), rarri (imp), ran.girri (t-pst) *'spear, stab'*, is a class II verb which cannot conveniently be fitted into one of the groups 9 through 13. At the time of writing, I have observed this verb inflected only for the categories listed above.

Class III group 14

nyini-ji	*'sit, be'*
gubi-ji	*'leave alone, go away'*
gingi-ji	*'think, consider, remember'*
bali-ji	*'die'*
nuki-ji	*'suck, ingest'*
galmi-ji	*'fall, blow down'*
milbali-ji	*'blink'* (lit. *eye-die*)
yawngi-ji	*'be afraid'*
wangi-ji	*'speak, say'*
jabirwangi-ji	*'yawn'* (lit. *mouth-say*)
ngurriwangi-ji	*'snore'* (lit. *nose-say*)
wirni-ji	*'return'*
buchalmi-ji	*'ask'*
galgali-ji	*'vomit'*
riki-ji	*'rain'*
walmi-ji	*'cross over'*

Class III group 15

burrchirri-ji	*'burn'*
marrngirri-ji	*'hear'*
walngirri-ji	*'dance, play'*
yilchirri-ji	*'move' (i.e. change the position of)*
kukirri-ji	*'walk about'*
birrmirri-ji	*'sing'*

Class III group 16

ngurri-ji	*'sleep'*
jirri-ji	*'stand, wake up'*

Class III group 17

jalngji-ji	*'like, desire, want'* (often occurs in the form jal with no inflection)
mirnji-ji	*'be cold'*
rdardawji-ji	*'stop, cease'*
jalgiji-ji	*'be hurt, hit oneself (in grief), be angry'*
yichiji	*'nod, give assent'* (suffix normally lacking in the non-past. But if suffix is present, verb takes the form yichiyi-ji)
gapirnji-ji	*'be wet'*
kumirji-ji	*'be cold'*
dalwarji-ji	*'be lazy'*
mardakarrichi-ji	*'be angry, seek trouble'*
dulpiji-ji	*'be sated'*
mirigiji-ji	*'be bad, be broken, be tired'*
ngalbirkiji	*'be intensely hungry, be intent on a course of action'* (suffix lacking in non-past)
gujirriji-ji	*'feel tired'*
wurpṃji-ji	*'be one'*

Also, the irregular verb: binji ∿ binchi (non-pst), binjirri (y-pst), biniyi (imp), bininyiri (t-pst-irr), binjini ∿ binchini (t-pst) *'say as follows, do like this'*, is a class III verb which cannot be fitted conveniently into one of the groups 14 through 17. At the time of writing, I have observed this verb inflected only for the categories listed above.

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