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Series A Volume 4

**A DISTINCTIVE FEATURES APPROACH TO
DJINANG PHONOLOGY AND VERB MORPHOLOGY**

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PREFACE

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INTRODUCTION TO
SERIES A VOLUME 4

The papers in this volume describe various aspects of Djinang phonology and verb morphology using a distinctive features approach.

The first two papers describe the phonology and verb morphology of the language respectively. The third paper is more theoretical in nature and proposes a distinctive feature, 'Narrow', to characterize rhotics and glides. The final paper discusses recent discoveries which are relevant to the other papers.

Bruce Waters has lived at Ramangining in north-central Arnhem Land with his wife Glenys and children since 1977, working under the auspices of the Summer Institute of Linguistics.

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DJINANG PHONOLOGY

Bruce E. Waters

0. 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 western-most member of the Yolngu languages¹ 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. It is interesting that Kirton (private communication) reports that gemination of voiceless stops also occurs in Yanyuwa, an "isolate" language in the east of the Northern Territory.

Yolngu languages apparently neutralize 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 Dr. 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.

1. 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 bapirurr 'group, clan' applies) and communalect names. This is no fault of Wood's, 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 replace² 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 complimentary to that given by Wood.

TABLE 1

Djinaṅg Clans, Communalects and Countries

<u>Moiety</u>	<u>Clan</u>	<u>Communalect</u>	<u>Country</u>
Dj	Ya <u>l</u> ingir	Yinbi <u>ng</u>	Dhabila creek area
Dj	Marrangu	Munggurpi	Between Glude river and Djinni creek, north of Murwanggi and south of Ramingi <u>ng</u>
Dj	Manyarrngu	Manyarrngu ³	West of Glyde river mouth
Dj	Murrungun	Wolkabi	Ngangga <u>l</u> ala area and east side of Glyde river downstream of Ngangga <u>l</u> ala
Y	Gilibirrparr	Wulaki	Gatji creek area
Y	Milji <u>ng</u> i	Madakarr	Both sides of Glyde river, further downstream than the Murrungun area
Y	Djadiwitjibi	Manyim	Ramingi <u>ng</u> area
Y	Ba <u>l</u> mbi	Wora	Yatjilimiri area north west of Ramingi <u>ng</u>
Y	Munyibingl	Bi <u>l</u> abi <u>l</u> a	Escarpment country west of Murwanggi area and Murwanggi area
Y	Däbi ⁴	Djonggi	East of Murwanggi

TABLE 2

Some Djining Groupings

<u>Moiety</u>	<u>Clan</u>	<u>Communalect</u>	<u>Country</u>
Y	Ganalbingu	not known to author	East of Glyde river upstream of Ngangga <u>l</u> ala, and probably other areas
Y	Djinba	Djinba ⁵	not known to author
Dj	Mandjalpi	Balawuy	not known to author
Dj	Ba <u>l</u> awuy	Gurrukurru	Goyder river area

2. THE SEGMENT

2.1 THE PHONEME SET

The Djinang phoneme inventory consists of twenty one 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- post- alveolar	lamino- post- alveolar	velar
voiceless stops	p	t	<u>t</u>	tj	k
voiced stops	b	d	<u>d</u>	dj	g
nasals	m	n	<u>n</u>	ñ	ŋ
laterals		l	<u>l</u>		
glides and rhotics	w	ř	<u>r</u>	y	

The alveolar rhotic, ř, is trilled

CHART 2

Vowel Phonemes

	non-back	back
non-low	i	u
low		a

2.2 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 were given in my paper "Djinang Verb Morphology" (elsewhere 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 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-continuant. 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

I have characterized 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".

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; non-distributed 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 a [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 vowels⁷, 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" (elsewhere in this volume). 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, l, n and n). 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, l, n and n) 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 evidences for the usefulness of the "narrow" feature. The interested reader is directed to my 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

"... features such as [consonantal] and [anterior], although commonly in use by phonologists, were not found useful".

Wood used the feature "high" to separate sounds that normally would be separated by the feature "anterior", for example, [t] from [ṭ] [n] from n, 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 (ṭ, ḍ, ṇ, ḷ, ṛ) and alveolar sounds (t, d, n, l, r) 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 thereby 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 characterizes [t, n, l, and ṛ] as [-high], but the retroflexives [ṭ, ḍ, ṇ, ḷ and ṛ] as [+high]. It could be argued both orders are [-high], or even that the alveolars are [+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 as to 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 my paper "Djinang Verb Morphology" I assumed that the basic contrast in the point of articulation of consonants was between peripheral versus non-peripheral consonants. Wood makes the same distinction (Wood, 1978). 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 Djinang⁸, 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 Dh⁹ 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 stated in terms of ...

$$[-\text{son}] \rightarrow \left[\begin{array}{l} +\text{vocalic} \\ -\text{syllabic} \end{array} \right] / [+cont] \text{ ______ } [+cont]"$$

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:

$$(a) \quad [-\text{son}] \rightarrow [+narrow] / [+cont] \left[\begin{array}{l} \text{______} \\ +\text{dist} \end{array} \right] [+cont]$$

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

$$(b) \quad [-\text{son}] \text{ ______ } [+son] / [+cont] \left[\begin{array}{l} +\text{dist} \\ -\text{nas} \end{array} \right] [+cont]$$

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	<u>t</u>
	+vce	b	g		dj	d	<u>d</u>
+son	+nas	m	ŋ		ɲ	n	<u>n</u>
	+lat					l	<u>l</u>
	+narr	w			y	ɹ	<u>r</u>

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 exception of stress, and held).

CHART 4
Fully Specified Feature Matrices

	p t j k	b d j g	m ñ ŋ	w y	ʃ ʒ	d ɗ	n ɲ	l ɭ	r ʀ	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 as -stress. The cyclic rules will then place stress at the correct places within the string.

2.3 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.

2.3.1 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 neutralizes it in some points of articulation (for example: Gaalpu, which retains the distinction only for true retroflexed stops). In addition, there is also neutralization due to distributional factors. For example, Wood (*ibid*) states that neutralization 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 neutralized at any of the points of articulation, nor is it neutralized word initially¹⁰ 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 neutralization.

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 /t̪/) do not occur word initially, and occur far less frequently than non-apical stops word-medially or word-finally. Voiced apical stops (/d/ and /d̪/) 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 /d̪/. Word medially, both occur following a homorganic nasal, or lateral, but intervocally /d̪/ 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 p̚, t̪̚, etc.), and long sonorant consonants will be marked by a macron "̄" above the consonant (for example m̄, l̄, r̄, 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 symbolized 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

/piřidjigi/	['piři.djǐge]	'moor a boat', 'start'
/biřmiřidji/	['biř.miři.dje?]	'sing'
/pařtji kǐri/	['pař.tji# kǐri?]	'will be spearing'
/bařitji/	['baři.tji?]	'long yam'
/puldjiban/	['pol.dji.ban]	'full up now'
/bulidji/	['boli.dji?]	'fly (insect)'
/tjalatjan/	['tjala.tjaǎ]	'south'
/djalǐrigi/	['djalǐri.ge?]	'bury'
/tjilǐtjigi/	['tjil.tji.ge?]	'leak' (verb, class 1)
/djilǐdjigi/	['djil.djǐge]	'cuddle'
/tjutǐtjutǐ/	['tjutǐ.tjutǐ]	'keep on doing it'
/djut/	['djuǐ]	'stop' (at a specified place)
/karguřiyili/	['kar.guři.yile?]	'outside'
/garpan/	['gar.pan]	'type of tree'
/kargi/	['kar.ge?]	'pick out of the fire'
/kařa/	['kařta?]	'large star'
/gaka/	['gaķ.ka:]	'bush snail shell'
/kuřitjiři/	['kuři.tjǐře]	'iron wood tree'
/guřumba/	['guřum.ba?]	'magpie geese'
/kaliki/	['kali.ke?]	'have, possess, look after'
/galiygi/	['galiy.ge?]	'turn on to its side'
/kukiřidji/	['kuķ.kiři.dji?]	'walk about looking for food'
/gubidji/	['gobi.dji]	'leave (it)', 'ebb'

MEDIAL CONTRASTS

/kupidjiři/	['ko ^u p̣i.djiře]	'be still at a task'
/gubidji/	['gobi.dji]	'leave (it)', 'ebb'
/katjigi/	['kaṭ].tjige [?]	'catch, hold on to'
/gadji ^u ri/	['gadji ^u re [?]]	'yesterday'
/ɲiltjan/	['ɲil.tján]	'of us' (dual, inclusive)
/ɲildjan/	['ɲil.djan]	'of you' (plur.)
/butji ^u ri/	['bo ^u ṭ].tji ^u re [?]]	'ear'
/budjiři/	['bodjiře [?]]	'stomach', 'belly'
/yakiři/	['yaḳ.kiře]	'asleep'
/yagiři/	['yagiře [?]]	'name'
/ɲir ^u ki/	['ɲiṛ.ke [?]]	'bone'
/ɲir ^u gi/	['ɲiṛ.ge [?]]	'pandanus fruit'
/butal/	['bo ^u ṭ].tal]	'good', 'well', 'satisfactory'
/budi/	['bode [?]]	'blood'
/matit/	['maṭ].tíṭ]	'hard'
/madim/	['madim]	'offal' (of fish)
/matamigi/	['maṭ.ta.míge]	'tie up', 'coil'
/dadawmigi/	['dadaw.mige [?]]	'prevent', 'cause to stop'

FINAL CONTRASTS

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

/mařkap/	['mař.ká ^u p̣]	'pleasing', 'wonderful'
/wukutj/	['woḳ.kúṭj]	'goanna'
/djarak/	['djaraḳ]	'fish spear'

/labut/	[^u 'labuʔ]	'type of wallaby'
/djařkuʔ/	[^u 'djař.kuʔ]	'sharp edge'

2.3.2 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 /n/) are articulated with a degree of retroflexion, and contrast only with respect to point of articulation; alveolar versus postalveolar (or domal), respectively.

INITIAL CONTRASTS

/mami <u>ri</u> /	[^u 'mami <u>re</u>]	'brain', 'mind'
/ñami/	[^u 'ñameʔ]	'saw', 'seeing'
/ɲambiři/	[^u 'ɲam.biře]	'mother'
/nami/	[^u 'nameʔ]	'on top of'
/ñuɲuɲ/	[^u 'ñuɲuɲ]	'your' (sing)
/ɲunɲi <u>ri</u> /	[^u 'ɲun.ɲi <u>re</u> ʔ]	'from that time'
		'from that place'
/nundjiři/	[^u 'nun.djiře]	'run', 'fly', 'drive'
/n <u>ungat</u> migi/	[^u 'nuɲ.gat <u>mi</u> ge]	'forbid', 'punish'

MEDIAL CONTRASTS

/ñami/	[^u 'ñameʔ]	'saw', 'seeing'
/ñañi/	[^u 'ñañeʔ]	'was seeing'
/ñani	[^u 'ñaɲeʔ]	'see', 'will see'
/ñani/	[^u 'ñaneʔ]	'he', 'she', 'it'
/bi <u>ni</u> /	[^u 'bineʔ]	'chest'

FINAL CONTRASTS

/lim/	[ˈlim]	diminutive of 'we' (plur. inclus.)
/liñ/	[ˈliñ]	diminutive of 'we' (dual exclus.)
/ñaliŋ/	[ˈñaliŋ]	'where?'
/kařalkaŋ/	[ˈkařal.káŋ]	'sing the announcement of a death'
/wiřiban/	[ˈweři.bán]	'nothing now'
/wuřupan/	[ˈwuřu.pán]	'emu'

2.3.3 LIQUID CONTRASTS

Liquids contrast word initially, medially and finally.

INITIAL CONTRASTS

/luŋgu/	[ˈluŋ.goʔ]	'harpoon'
/luřkal/	[ˈluř.kál]	'waist'
/řiřkiyañ/	[ˈřiř.kiyáñ]	'rock'
/řikiđji/	[ˈřik.ki.đjiʔ]	'rain' (verb)

MEDIAL CONTRASTS

/galbi/	[ˈgal.bi]	'many'
/gułtji/	[ˈguł.tjeʔ]	'fat'
/guřuŋ/	[ˈguřuŋ]	'cousin'
/bārim/	[ˈbārim]~[ˈparim]	'overflowing', 'spreading'

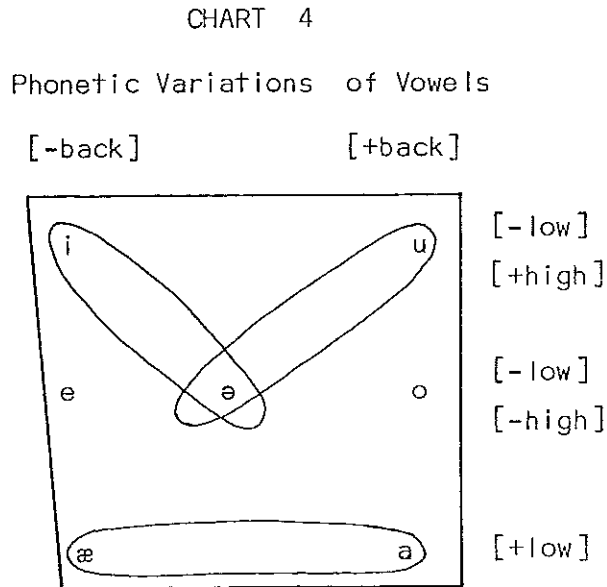
FINAL CONTRASTS

/djawal/	[ˈdjawal]	'area of land, possessed by a landowner'
/djagał/	[ˈdjagał]	'saliva'
/djiwař/	[ˈdjiwař]~[dji'wař]	'far above'
/wirar/	[ˈwirar]	'with who?'

2.4 PHONETIC VARIATIONS OF SEGMENTS, AND THEIR RELATION TO STRESS

2.4.1 VOWEL VARIATIONS

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



VARIANTS OF /a/

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

[+low] → [-back] / $\left[\begin{array}{l} +\text{dist} \\ -\text{periph} \end{array} \right] \text{ — [-back] (optional)}$

EXAMPLES

/giyañ/	['giyæñ]	'ant'
/řiřkiyañ/	['řiř.kiyæñ]	'rock
/ñaliki/	['ñæli.kiʔ]~['ñali.kiʔ]	'which way?'
/yaɾimban/	['yæɾim.bán]~['yaɾim.bán]	'but'
/tjaliřdjigi/	['tjæliř.djige]~['tjaliř.djigeʔ]	'break' (waves)

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

/dja-tjaliřdjigi/	[dji? 'tjæliř.djige]	'breaking' (waves) (durative aspect)
/řiřkiyaň/	['řiř.kíyiň]	'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 neutralization. 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 realized as [i]. Compare the more slowly spoken ['řiř.ki^áy^áň] '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 #CVC#, the final vowel frequently is lowered to [e] and followed by glottal stop. Word final /u/ is similarly frequently lowered to [o].

EXAMPLES

/wali/	['waleʔ]	'vegetable food'
/gaditi/	['gaditeʔ]	'sister'
/bařawu/	['bařa.woʔ]	'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

/bařawu/	['bařa.woʔ]	'canoe'
/djilaku/	['djila.koʔ]	'type of kangaroo'
/djuŋulu/	['djuŋuloʔ]	'mad, 'crazy'
and also		
/giřala/	['giřala]	'ibis'
/djimuřu	['djimuřu]	'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

/wuřuŋi/	['woru.ŋe]	'old person'
/biligi/	['beli.ge]	'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)
/wui/	['wo:we]	'older brother'
/giři/	['ge:ře]	'finished', 'next'
/ŋadji/	['ŋa:dji]	'cry'

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

/djidji/	['dji:dje]	'sore', 'a split'
/ŋili/	['ŋi:le]	'we' (dual, inclus.)

However, in fast speech, phonetic length on the vowel is reduced. Thus /giři/ 'finished', 'next', when spoken quickly, is usually heard as [ˈgiř̩]. (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/ [ˈme:dʒi] 'grandmother', we get /midjaw/ [ˈmedʒaw] 'all the grandmothers'. Similarly /wuwaw/ [ˈwuwaw] 'all the brothers'.

Elision of the initial consonant of a pronoun also reduces vowel length; thus /ŋili/ [ˈŋi:le] has the allomorph /il/ [il] 'we' (dual, inclus.).

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 /yuti/ [ˈyot̪.t̪eʔ] 'egg'.

So, in primary-stressed syllables we observe that there is optional lowering of high vowels to non-high, 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 1 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:

/badiridjigi/ [ˈbadiri.dʒige] '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:

/buřdjĩdjigi/ ['buř.djĩ̇.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 4.2, 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 ['CVCVʔ], hence /wali/ ['waleʔ] 'vegetable food'. If the second consonant is a voiceless stop, such a word would be articulated as ['CVCCVʔ], hence /waʈi/ ['waʈ.tiʔ] 'wind'. For a word of form #CV#, the normal articulation is an unknown quantity, as there are 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: ['gaḳ.kaʔ], third repeat:

['gaḳ.ka:]

/na/ 'bark canoe'

first repeat: ['na:], second repeat: ['naʔ]

/nu/ 'foot', 'root'

first two repeats: ['no:], third repeat: ['noʔ]

Hence it is clear that vowel length, word-final glottal stop, lowering of high vowels, gemination of voiceless stops, and stress, are all inter-related phenomena in Djinang. Thus it behoves 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 NEUTRALIZATION

To complete the discussion of vowel variants, we must examine the neutralization 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:

/bidak/	[bi'dak]~[bə'dak]	'wait a moment'
/dubuk/	[dú'buk]~[də'buk]	'carry', 'pick up'
/djubuy/	[djə'buy]~[dji'buy]~[dju'buy]	'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 realization 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:

/gu-guři/	[gəʔ.'nořeʔ]	'is sleeping'
/pu-pumi/	[pəʔ.'pome]	'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 Waters, (forthcoming, a).

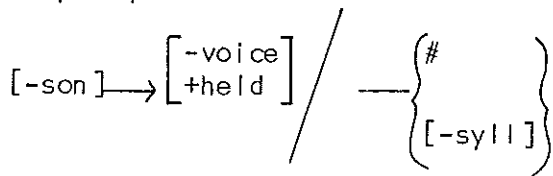
The vowel /a/ is highly resistant to being neutralized to schwa. The only examples that I have of /a/ being neutralized (though not to schwa) are:

/řiřikiyan/	['řiři.kiyiñ]	'rock'
/dja-tjaliřdjigi/	[djıʔ.'tjæliř.djige]	'breaking' (waves) (durative aspect)

2.4.2 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.)



EXAMPLES

/miyilk/	[^h 'miyilk]	'woman, wife'
/kayitj/	[^h 'kayitj]	'shovel-nosed spear'
/kupidjiři/	[^h 'kop.pi.djříre]	'tardy, 'still doing (something)'
/mukmigi/	[^h 'mok.migeʔ]	'cause to cease talking'

RHOTICS

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

/muřibin/	[^h 'muři.bín]~[^h 'muři.bín]	'heavy'
/muřuřt/	[^h 'muřuřt]~[^h 'muřuřt]	'plains grass'

The alveolar rhotic is also often heard as a (retroflexed) postalveolar [ɽ], 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

/wařwař/	[^h 'wař.'wař]~[^h 'waɽ.'waɽ]~[^h 'wa:wa:]	'follow after (an event)', 'be complete'
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The retroflexion of the postalveolar rhotic, /ɽ/, is also frequently reduced in fast speech when a vowel precedes. Thus:

/waɽařiň/	[^h 'waɽ.ɽařiň]~[^h 'wa:ɽařiň]	'so-and-so'
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3. THE SYLLABLE

3.1 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, <u>de</u> ʔ ¹²	'blood'
'wi <u>n</u> , <u>de</u> ʔ	'antbed', anthill'
'wu <u>r</u> ^u <u>p</u> ,meʔ	'one'

MEDIAL POSITION

' <u>na</u> ,mi,ge	'paint' (verb)
'ba, <u>man</u> ,peʔ	'from long ago', 'old one'
ni,' <u>dji</u> ^u <u>r</u> ^u <u>k</u> ,neʔ	'near'

FINAL POSITION

'bo,meʔ	'hitting', 'hit'
'dji,niŋ	'this'
'bo,maŋ	'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

í	'we' (dual, inclus.)
'e,ře	'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/	[¹ iŋ.kiʔ]	'no', 'not' (emphatic)
/indʒi/	[¹ in.dʒiʔ]	reciprocal/reflexive marker

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

/inga/	[¹ in.gaʔ]	'for him', 'for her'
/ingiř̃/	[¹ in.gíř̃]	'I, for him/her' (port- manteau)
/inma/	[¹ in.maʔ]	'for you' (sing)
/Inmir/	[¹ in.miř̃]	'I, for you (sing)' (portmanteau)

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

The above facts argue for omitting V and VC as underlying syllable types in Djingang, 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:

[ŋí ¹ dʒiř̃k.ŋ]	'near'
[¹ wurp̥.m]	'one'
[¹ biř̃.m.bán]	'is hitting now'

Syllabic nasals may occur only word medially or finally.

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

[l̥. ¹ leř̃.mim]	'keeps turning around'
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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 /Ni/ syllables, I am not positing these as a separate syllable type.

3.2 SYLLABLE PROSODIES

In Wood's paper "Some Yuulngu Phonological Patterns" (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 inter-relationship 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.

3.3 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 neutralized with respect to voicing and hence becoming voiceless. The only apparent counter-examples occur in class 1 or class 111 verbs, inflected for today-past-irrealis (or today-past-continuous). Thus we get:

[ʔnoyiñtj.ñiꞤ] 'sneezed' (irrealis)

from an underlying nu,yiñ,dji,ñiꞤ (Waters, forthcoming, a)

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
<u>l</u>	k	
ř	p,t,k	
<u>r</u>	p,k	
w	k	

3.4 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, n, l, l, ř and r) may not follow another consonant, and so the non-distributed sonorant columns have also been eliminated from the chart.

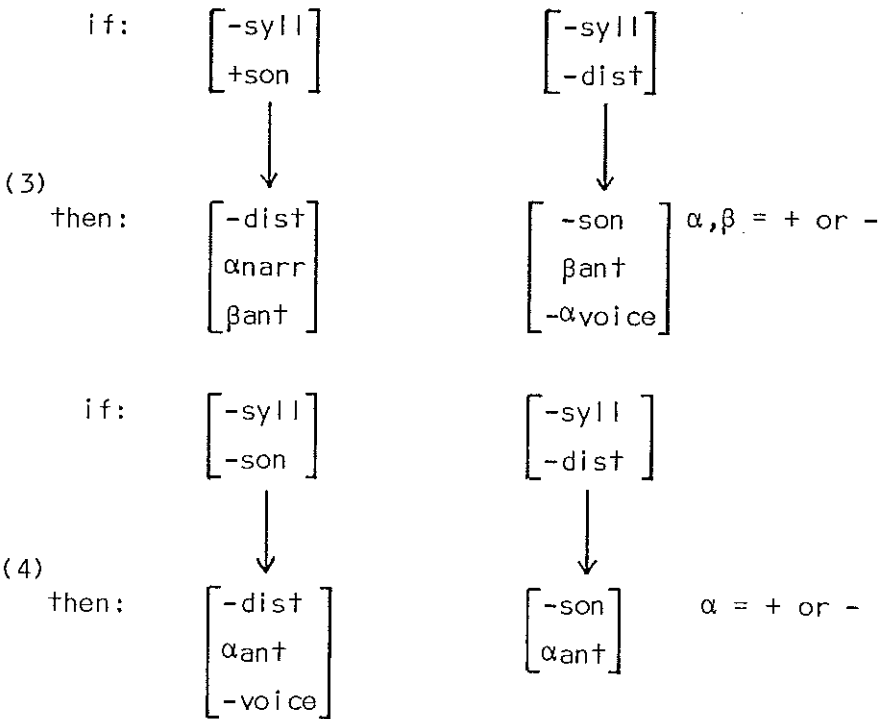
CHART 6

Consonant Clusters

C ₁ \ C ₂		+dist					-dist	
		-son			+son		-son	
		p t j k	b d j g	m ñ ŋ	w y	ṭ ṭ	ḍ ḍ	
+dist	-son	p		+	+++			
		tj	+	++	++			
		k		R+	+ +	R		R
	+son	m	+ +	++	++			
		ñ	+ +	+ +	+			
+son	ŋ		+ + +	+++			R	
	w		+ +	+ +				
	y	+ + +	+ + +	+	+		R	
-dist	-son	ṭ	+ R R	+	+			
		ṭ	+ R R	+ R	+			+
	+son	n	+ + +	+ + +	+ +			+
		<u>n</u>		+ + +	+++			+
		l	+ + +	+ + +	+++	++		+
		<u>l</u>	+ + +	+ +	+ +	+		
		ř	+ + +	+ + +	+ +	++		+
<u>r</u>	+ + +	+ + +	+ +	+ 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, t̥, d or d̥), 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 r̥t, tt, rt̥, t̥t̥, ld, ld̥, nd, nd̥, and td̥; but not, say, *r̥d, *rd̥, *lt̥, *lt̥t̥, *nt̥, *nt̥t̥. Reduplications, which give rise to kd, nd and yd in chart 6, are not counterexamples. The reduplication boundary is a word boundary (#) and phonotactic constraints do not apply across such boundaries¹⁵.

We can express the above conditions by the following constraints:



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

/di [| d̥i | .d̥i |] | | '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 /řt/ sequence, occurs in the coda of a CVCC syllable:

[^h'muřuřt̪] '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 t̪, compared with d and d̪, 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.

4. STRESS GROUPS

4.1 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:

/milku|t̪jind̪jigi/ [^h'me:l.kú|̣.t̪jíṇ.d̪jíge] 'civet'

/milbur̪kbur̪kd̪jim/ [^h'mel.búrḳ̣.búrḳ̣.d̪jím] 'aim' (gun or spear)

(The morpheme [^h'me:l]~[^h'mel] means 'eye', and is very productive in forming compounds).

/ñan̩g̩g̩iɾ/ [^h'ñan̩.g̩á̩.g̩íɾ] '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 3.4, 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 footnote 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 three¹⁸ 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

/balŋidjidji/ [~~'balŋ.gɪyɪ.djé?~~] 'be afternoon'

/bambuli/	[^ˈ bam.ɔ́təʔ]	'bark'
/badadji/	[^ˈ bada.djɪʔ]	'banyam tree'
/pagapagadjuw/	[^ˈ paga# ^ˈ paga.djɪw]	'stagger', 'be raving'
/bilay/	[bi ^ˈ 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), 'CVCVVC(C).

EXAMPLES

open type,

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

closed type,

/yul/	[^ˈ yo:l]	'man', 'husband'
/galŋ/	[^ˈ galŋ]	'body'
/midjiř/	[^ˈ midjiř]	'dust'
/bumalŋ/	[^ˈ bumalŋ]	'shade'
/djumiliŋ/	[^ˈ 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 as follows.

['bo: .gǫ́nǫ]	'having faeces', 'not fat', 'dried up'
[dǫ́řa .djiǵe?]	'eat'
[ŋǫ́ř .djiřk̄ .ŋ .bǫ́n]	'near now'
['ba li .dje?]	'die'
['ba ři .tji?]	'long yam'
['gadji .gǫ́ře]	'on the track'
['gala .káŋi]	'uncover', 'sweep area clean' (from #galaka+ŋi#)
['gadji .gǫ́ř]	'track', 'road'
['mi ŋi .ká l]	'clothes'
['gadji .gǫ́ři]	'at a point on the track'
['go di .tjimá ř]	'small star'
['bagi li .ge?]	'fetch'
['mi ŋi .gi .pǫ́le]	'bad ones'
['yo wi ŋi .djiǵŋ]	'new ones'
['gu řu ta .gǫ́nǫ]	'having kin relationship'
['ya ri .tjiǵe?]	'tear'
['ŋu řu .bǫ́ři .dji?]	'perspire'
['paga .paga .djiǵe]	'stagger', 'be raving'
['bu řu .bu řu .pǫ́ŋim]	'one after another' (events)
['ňi ni .ňǫ́ŋ .be?]	'for sitting', 'a chair'
['dji ni .pǫ́n .gumá?]	'right here now'
['dja řa .pǫ́n .djiǵi .ge]	'spread out a bed on the ground'
['wi ni .djiǵi .ge?]	'take back'
['be m .be?]	'noise'
['ba m .bǫ́le]	'bark'

['galm.ŋúře]	'repeatedly falling'
['muytj:píni.ge?]	'build'
['gin.di.lále]	'bring to land' (from water)
['djan.ŋán]	'their' (plur)
['durk.'durk]	'heart'
['wen.góni_r]	'wrong handed', 'left handed'
['djal.tji.be?]	'from the ground'
['man.di.gíniŋ]	'crocodile'
['djam.bi.djíge]	'change'
['gu_l.wíři.dji?]	'palm trees'
['dju_k.már.ge?]	'spit'
['butj.ńí_r.djíge?]	'break by pulling', 'sever'
['ŋuy.már.gíniŋ.djíge]	'hate'
['dam.píliñ.djúw]	'make it short!'
['djimi_n.de?]	'short spear'
['beneŋ.gile?]	'two'
['gibil.bál]	'ashes'
['malip.máli_r]	'future time'. 'tomorrow'
['bulan.gít.djín.ma?]	'this is good'
['dja_l.wíři.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.

4.2 PROMINENCE

In section 2.4.1, it was shown that certain phonetic properties (for example; stress, length voiceless stop gemination, and glottal stop) appeared to be inter-related. In this section, and in the sections to follow, we shall explore the nature of these and other inter-relationships. 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 (*ibid*) 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 2.4.1 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 [ʔoŋe] 'sleeps', becomes [ŋəʔ.ʔoŋeʔ] '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/	[ʔwuy.ʔwuy.tjigeʔ]	'shake to and fro'
/wudu <u>wudu</u> djigi/	[ʔwudu.ʔwudu.djige]	'wrap', 'fold'
/pagapagadjigi/	[ʔpaga.ʔpaga.djige]	'stagger'
/djiřidjiřidjigi/	[ʔdjiři.ʔdjiři.djige]	'go down'
/būwal <u>buwal</u> djigi/	[būʔwal.būʔwal.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 "separator" 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 fall 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.

4.3 GEMINATION OF VOICELESS STOPS

Gemination of voiceless stops is apparently a widespread phenomenon in Aboriginal languages. (McKay, 1975; McKay, 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, private communication), spoken in the Gulf country near Borroloola.

Some researchers (McKay, 1975; McKay, 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 ungeminated (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 intervocally 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.

/bap _i /	['bap̥̥ .peʔ]	'shoulder'
/matamigi/	['mat̥̥ .ta.miʔge]	'tie up', 'coil'
/k _a ta/	['kḁ̥ .taʔ]	'bright star'
/bat _j i/	['bat̥̥ .t̥ji]	'dilly-bag'
/buka/	['buk̥̥ .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.

/gad _i t _i /	['gad _i teʔ]	'sister'
/bap _i pi/	['bap̥̥ .pipeʔ]	'aunt'

/djilaku/	['dʒiːla.koʔ]	'type of kangaroo'
/kukuřum/	[kuʔ. 'kuřum]	'hanging' (durative)
/kukiřidji/	['kuḱ.kíři.dʒiʔ]	'walk about'
/bařitji/	['baři.tʃiʔ]	'long yam'
/katjin kirim/	['katʃ.tʃín.kírim]	'gathering', 'collecting'
/djinipilarŋ/	['dʒini.pilánŋ]	'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 ['bap̩pile], and the geminate cluster thus produced re-triggers the rule²² for placement of stress group boundaries, to produce ['bap̩.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 follow:

/miki/	['meḱ.keʔ]	'red ochre'
/watiri/	['waṯ.tireʔ]	'by the wind'
/bipini/	['biṗ.pineʔ]	'hit', 'made'
/dutjigi/	['duṯ.tʃi.geʔ]	'squeeze'
/kupidjiři/	['koṗ.pi.dʒíře]	'be still doing it'
/wukiřidjigi/	['woḱ.kíři.dʒígeʔ]	'write'
/mapal/	['maṗ.pál]	'hair', 'leaf'
/gikaŋgi/	['giḱ.kán.geʔ]	'bird name'
/dupinmiři/	['doṗ.pín.míře]	'in the bone pole'
/wupudjuw/	['woṗ.púṗ.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/ 'reciprocal/reflexive marker'. Thus we have the following:

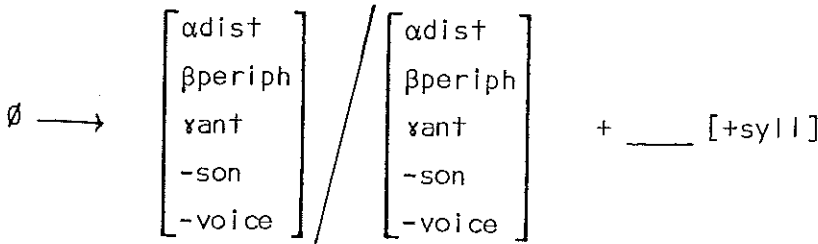
/bid _u kipm/	[bə' d _u k ^h .kí ^h p̄.ṃ]	'just wait a while'
/ŋu ^h uwakapm/	['ŋu ^h u.wá ^h k̄.ká ^h p̄.ṃ]	'just the first'
/butjindji ^h rkun/	['bot̄].tjín.djír̄.kú ^h ŋ]	'listen'

(literally: 'give one's own ear')

The stem in the first example is /bid_uk/, that of the second is /ŋu^huwak/, and that of the third example is /butj_i/, (which is a diminutive form of /butjiri/ '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.kú^hp̄.ṃ] 'just have a look', rather than *['melik̄.kú^hp̄.ṃ].

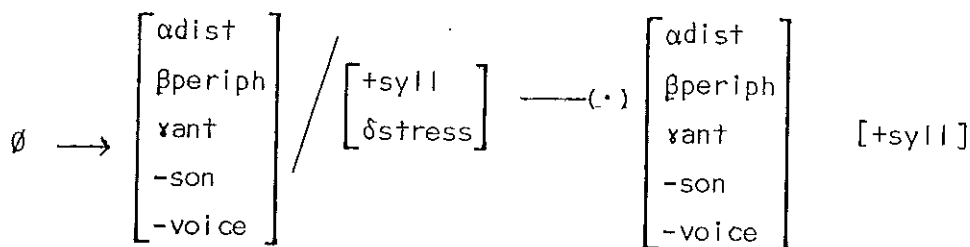
The rules for progressive and regressive gemination are as follows:

PROGRESSIVE GEMINATION RULE



where $\alpha, \beta, \gamma = +$ or $-$

REGRESSIVE GEMINATION RULE



where $\alpha, \beta, \gamma = +$ or $-$, and $\delta = 1$ 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.ki^htʃ.tjidje?] '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 $[+\text{dist}] V [+ \text{son}] V ([+\text{son})^{2,3}$, 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 t^h) 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.

4.4 LENGTHENING OF SONORANT CONSONANTS

In section 4.2 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/	['wañaʔ]	'big'
/bala/	['baŋaʔ]	'European style house'
/yanaŋ/	['yañŋ]	'talk'
/baman/	['baṃan]	'a long time'
/gařay/	['gařay]	'wonderful'
/djaya/	['djaṃa]	'slowly', 'less'
/djayař/	['djaṃař]	'pandanus palm'
/mañŋ/	['mañŋ]	'try', 'find', 'test'
/rala/	['raŋa]	'hole'
/waray/	['wařay]	'perhaps'
/muŋan/	['moṃan]	'lower back', 'down river'
/ba <u>ru</u> w/	['ba <u>ru</u> w]	'spread it'

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

4.5 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 on to a following syllable containing the vowel /a/.

/diřadjigi/	[dí'řa.djigeʔ]	'eat'
/djudapdjigi/	[djú'dap̣.djíge]	'sneak up', 'stalk'
/giřabili/	[gí'řa.bileʔ]	'ashes'
/wiran̩/	[wí'ran̩]~['wiran̩]	'whose?'
/wirar̩/	[wí'rar̩]~['wirar̩]	'with who?'
/bidak/	[bí'daḳ]~[bə'daḳ]	'wait'
/biřal/	[bí'řal]	'true'
/biral/	[bí'ral]	'withered', 'lifeless'
/milařdjln/	[mí'lař.djln]	'downwards'

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

/bilapilan̩/	['bila.pilán̩]	'it is like that'
/guditjimař/	['godi.tjimář]	'small star'
/gindilali/	['gin̩.diláleʔ]	'bring to the land' (from the water)
/ninbilan̩/	['nin.bilán̩]	'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/	['pi ^h k̄.káŋ]	'fishing line'
/djuka _l /	['dju ^h k̄.ká _l]	'type of fish'
/butjalak/	['bu ^h t̄.tjalá ^h k̄]	'yellow ochre'
/gikaŋgi/	['gi ^h k̄.káŋ.geʔ]	'type of bird'
/ŋiřaŋ/	['ŋiřaŋ]	'my'
/djiwař/	['djiwař]	'high above'
/gunař/	['gonař]	'type of fruit'

The following rule handles the stress shifting²⁵ discussed thus far:

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

where $\alpha = 1$ 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/	[ŋi ^h djiřk.ŋ]	'close to'
/djiřiy/	[dji ^h řiy]	'stand up!'
/gunbuluřu/	['gun.bulóřo]	'type of thick-stemmed grass'
/ma _r ayin/	[má ^h rayin]	'sacred, powerful'
/djubuy/	[dju ^h buy] ~ [djə ^h buy]	'go away'
/indjiř/	[ín. ^h djiř] ~ ['in.dji ^h ř]	'reflexive + I' (portmanteau)

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:

/guraki/	[gú'raċ.keʔ]	'nape of neck'
/yiřatjigi/	[yí'řat].tjigeʔ]	'scratch'
/wiřapili/	[wí'raĉ.pileʔ]	'which ones/'
/-giřapi/	[-gí'raĉ.peʔ]	'from' (suffix)

5. PAUSE GROUPS

5.1 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 symbolized 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-biŋi /
you tobacco -dative likes-one who
You are a person who likes tobacco.

- 2 /madjiři ěimi /
 next what
 What next?
- 3 /ńadji bil wini -dji bapili /
 when they (dual) return-future (to) here
 When will those two come back here?
- 4 /ńani Tasha \ gadjir -a \
 she Natashia yesterday-setting marker
 ŋa- ŋadji /
 durative aspect-crying
 Natashia was crying yesterday.
- 5 /djuŋ -iřa \ bilay -ŋiri \ iři minali /
 wood -my a long way-from I carried (it)
 I carried my wood from a distant place.
- 6 /mayuřk indji malim -dji -g -a \
 rain itself finish-verbalizer-future-setting marker
 ŋunu -kinin -ban iři giri /
 that (time)-having-then I go (future)
 When the rain finishes, I will go.
- 7 /munacha \ ŋuńili ŋiřa-li \ guřbi-le \
 sand (to) that my-to camp -to
 iři biřu-gi /
 I take-future

I will take sand to my camp

This data was 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. bá^hk. ku. ge. 'djaŋ. bi^hne?]
- 2(a) ['madjiře. 'ñi:me?]~
- 2(b) ['madjiře. 'ñi:m̄e?]
- 3 ['ñadji. 'bil. 'wi^hni. dji. 'ba^hp. pi^hle?]
- 4 ['ñani. 'Tasha: \ 'gadji^hra: \ ŋə? . 'ŋa:dje?]
- 5(a) ['djuŋ. gi^hřa? \ bi'lay. ŋi^hre? \ 'eře. 'minale?]~
- 5(b) ['djuŋ. gi^hřa: \ bi'lay. ŋi^hre: \ 'eř. 'minale?]
- 6 ['mayu^hřk. 'in. dji. 'malim. dji^hga: \ 'ŋunu. kí^hŋi^hŋ. bán. di^hře. 'gi^hre]
- 7 ['muna. tja: \ 'ŋu^hñili. 'ŋi^hřale: \ 'goř. bi^hle: \ 'eře. 'bi^hřu. ge?]

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 2.4.1) that glottal stop does not function as a word closure mechanism in discourse.

In section 4.2 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.bine?] rather than #['djalŋ.bine]; in 5(b) we get [bil'lay.ŋire:\] rather than #[bil'lay.ŋire:\]; and in 6 we get ['malim.djiga:\] rather than #[malim.djiga\]. We shall say more about this later on.

In utterance 6 we observe that the morpheme /iĩi/ (which is a diminutive of /ŋaĩi/ 'I') is phonologically attached to the preceding word, via a transition consonant [d]. This transition consonant satisfies the constraints on consonant clusters²⁷, and is required in order to ensure that the /iĩi/ 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 Djingang.

8 /a bintji giri \ a bintji giri

and like this go (future) and like this go (future)

This is what I will do, I will go

Yatjilimir -ii \ a ŋuli waŋi -dji \

Yachilimiri -to and there speak -future.

to Yachilimir and speak (Djingang) there.

djani ñaliki-dji waŋi -dji 'malu \

they how -future speak -future: daddy

In the manner that they speak: daddy,

a ŋiřaŋ wuwi mala \ a ŋiřaŋ gaditi mala \

and my brother plural and my sister plural

and my brothers and sisters,

ñaliki djin wangi -dji \

how they speak -future

how they speak (Djinang)

iři -ñ djin marangi -dji -gi /

me -accusative they teach -verbalizer-future

they will teach me.

- 8 [a.'ben.tji.'gíre: \ a.'ben.tji.gíre.'yatj.tjíli.míř.le? \
a.'no:le.'wagi.dji? \ 'djan.'ñali.kídjí.'wagi.dji.'ma:lu: \
a.'ñiřaŋ.'wo:we.'ma:la: \ a.'ñiřaŋ.'gadite.'ma:la? \
'ñali.ki.'djin.'wagi.dji \ 'eřiñ.'djin.'marangí.dj[ge?]

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 4.2, 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:lu:] '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 pause group containing "setting" information, such as the first pause group of utterance 6); level (used in the 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 (\uparrow), falling pitch (\downarrow), and level pitch (\rightarrow).

- 1 [\downarrow]
- 2 [\downarrow] (2(a) and 2(b))
- 3 [\downarrow]
- 4 [$\rightarrow \backslash \rightarrow \backslash \downarrow$]
- 5 [$\rightarrow \backslash \rightarrow \backslash \downarrow$] (5(a) and 5(b))
- 6 [$\uparrow \backslash \downarrow$]
- 7 [$\rightarrow \backslash \rightarrow \backslash \rightarrow \backslash \downarrow$]
- 8 [$\rightarrow \backslash \rightarrow \backslash \rightarrow \backslash \rightarrow \backslash \downarrow \backslash \downarrow \backslash \downarrow$]

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 placement²⁸, and some of the prominence shifting rules will be left till section 7. 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 6.2. 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 [#djama#dji#gi] ,
verb
verb

will be converted to [#djama+dji+gi#] . The symbol "#" will then
verb
verb

represent true word boundaries only. Also, a phonological word (that is, a pause group), will be delimited by ##. Hence, between grammatical words in the 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

$$\begin{array}{c}
 [1 \text{ stress}] \\
 1
 \end{array}
 \begin{array}{c}
 \left[\begin{array}{c}
 \text{-seg} \\
 \text{-glot}
 \end{array} \right]^{29} \\
 2
 \end{array}
 \xrightarrow{\text{DA } 30}
 \begin{array}{c}
 \left[\begin{array}{c}
 1 \\
 \text{-stress}
 \end{array} \right] \left[\begin{array}{c}
 2 \\
 \text{+glot}
 \end{array} \right]
 \end{array}$$

PRE-PAUSE PROMINENCE

$$[-\text{stress}] \rightarrow [2 \text{ stress}] / \left[\begin{array}{c} \text{---} \\ \text{+syll} \end{array} \right] \backslash$$

HIGH VOWEL LOWERING IN PROMINENT SYLLABLE (Optional)

$$[+high] \rightarrow [-high] / \left[\begin{array}{c} \text{---} \\ 1 \text{ stress} \end{array} \right]$$

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)

$$[+high] \rightarrow [-high] / \left[\begin{array}{c} \text{---} \\ 2 \text{ stress} \end{array} \right] \backslash$$

VOWEL LENGTHENING BY PROMINENCE (Optional)

$[-\text{long}] \rightarrow [+ \text{long}] / \left[\begin{array}{c} \text{---} \\ 1 \text{ stress} \end{array} \right] \left\{ \begin{array}{l} \# \\ \text{CV} \end{array} \right\}$

VOWEL LENGTHENING BEFORE PAUSE (Optional, but perhaps influenced by pitch)

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

GLOTTAL AS PROMINENCE BEFORE PAUSE (Optional, but perhaps influenced by pitch)

$\emptyset \rightarrow \left[\begin{array}{c} -\text{seg} \\ +\text{glot} \end{array} \right] / [2 \text{ stress}] \text{---} \backslash$

PROMINENCE REALIZATION AS STRESS (see footnote 31)

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

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 $[\alpha \text{ stress}]$ feature (where $\alpha = 1$ or 2) and then be interpreted as stressed syllables at the completion of the transformational cycle.³¹

Finally, if "pre-pause prominence" has been applied, then of the three rules "high vowel lowering 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.

5.2 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 (*ibid*) 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 "normalize" 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.

6. RULES AND RULE ORDER

6.1 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

strings. For example, I have not given a rule that permits prominence to shift to the second syllable in /indjiř/ ['in.djǐř]~[in.'djǐř] 'reflexive + I' (portmanteau). 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 kirim/ 'holding on' (habitual) are always articulated as ['katj.tjǐn.kirim]. Another, (rule 23), frequently changes /i/ to [u] in the contexts p_{gi}#, ŋ_{pm}#, and so forth. For example, /milikipm/ ['meli.kúp.ŋ]~['meli.kíp.ŋ] 'just have a look'.

Another device I have employed are 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 . → ∅ 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/ [bǐ'layile] 'to a distant place', and /diřadjigi/ [dǐ'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, /djarakipm/ 'just a spear' would be segmented as djara.kip.m, leading to the deviant output *['djara.kúp.ŋ]. The progressive gemination rule derives djarakkipm, which will be segmented as djarak.kip.m leading to the correct form ['djarak.kúp.ŋ].

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, "verbalizer and non-past tense" are usually one rhythmic unit ".dji'ge.". 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 explained in footnote 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 necessitate "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 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 5.2). 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 ['bap̩.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 realized as a lowered high vowel followed by a glottal closure, hence ['bap̩.pile?].

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

$$*[-stress] \rightarrow [1 \text{ stress}] / \#(C) \left\{ \begin{array}{l} [-seg] \\ [-glot] \\ (C) C \left\{ \begin{array}{l} [-stress] \\ \# \\ C \end{array} \right\} \end{array} \right\}$$

and

$$*[-stress] \rightarrow [2 \text{ stress}] / \left\{ \begin{array}{l} \# \\ . \end{array} \right\} C \left[\begin{array}{c} \text{---} \\ [-schwa] \end{array} \right] \left\{ \begin{array}{l} \left\{ \begin{array}{l} \# \\ \backslash \end{array} \right\} \\ C(C) \left\{ \begin{array}{l} [-seg] \\ [-glot] \\ [\alpha \text{ stress}] \end{array} \right\} \end{array} \right\}$$

where $\alpha = 1$ 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 an consonant, both rule 26 and rule 32 are blocked and the prominence is realized as (phonetic) stress. Although such stress groups are quite rare, all the data that I have supports this:

/butji butpiŋi _{ra} ŋ/	['boʔ ^u ʃ.tʃi. 'boʔ ^u .píŋi _{ra} ŋ]	'it's about to get away
/bubaliki _{ni} ŋ/	['bubale.kí _{ni} ŋ]	'any time'
/bubaliki _{ni} m/	['bubali.kí _{ni} m]	'anywhere'

The above mechanism is a way where there can be two prominent syllables in one stress group. Normally, the final prominence is realized 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 footnote 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.ke?] '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 realized as high vowel lowering, glottal stop closure, or both, in the appropriate environments (rules 26, 27, 28). If none of the rules realize 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 5.1:

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

The rules segment this and place prominence as follows:

'djam.báku.gi, then 'djam.bák.ku.gi. Then rule 22 places secondary prominence on the final syllable, to obtain ['djam.bák.ku.ge], as in utterance 1 of section 5.1.

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:

[-long] → [+long] / $\left[\overline{\quad} \right]_{2 \text{ stress}} \setminus \text{OPT}$, and

[-long] → [+long] / $\left[\overline{\quad} \right]_{1 \text{ stress}} \left\{ \begin{array}{l} \# \\ \text{CV} \end{array} \right\} \text{OPT}$. 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 5.1.

As can be seen from utterances 1 through 8 in section 5.1, 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 "\, #" 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, paralleling 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

$$\begin{matrix} \# \# \\ 1 \ 2 \end{matrix} \rightarrow \left[\begin{array}{c} 1 \\ \backslash \end{array} \right] \emptyset$$

(2) PROGRESSIVE GEMINATION

$$\emptyset \rightarrow \left[\begin{array}{c} \alpha \text{dist} \\ \beta \text{periph} \\ \gamma \text{ant} \\ -\text{son} \\ -\text{voice} \end{array} \right] / \left[\begin{array}{c} \alpha \text{dist} \\ \beta \text{periph} \\ \gamma \text{ant} \\ -\text{son} \\ -\text{voice} \end{array} \right] + \text{---} V$$

where $\alpha, \beta, \gamma = +$ or $-$

(3) CLUSTER SEGMENTATION

$$\emptyset \rightarrow \cdot / \left[\begin{array}{c} \# \\ . \end{array} \right] X (C) C \text{---} C Y \left[\begin{array}{c} \# \\ . \end{array} \right]$$

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

(4) NORMAL SEGMENTATION (optimal pattern)

$$\emptyset \rightarrow \cdot / \left\{ \begin{array}{c} \# \\ . \end{array} \right\} CVCV \text{---} [+dist] (VC(VC))V(C) \left[\begin{array}{c} -\text{seg} \\ -\text{glot} \\ -\text{FB} \end{array} \right]$$

(5) FOUR AND FIVE SYLLABLE SEGMENTATION (alternative pattern)

$$\emptyset \longrightarrow \cdot / \left\{ \begin{array}{l} \# \\ \cdot \end{array} \right\} \text{CVCV}[-\text{dist}] \text{V} ______ [+ \text{dist}] (\text{VC}) \text{V} (\text{C}) \begin{bmatrix} -\text{seg} \\ -\text{glot} \\ -\text{FB} \end{bmatrix}$$

(6) FOUR SYLLABLE SEGMENTATION (adjustment)

$$+ \longrightarrow \cdot / \text{C.CV} ______ [+ \text{dist}] \text{VCVCV} (\text{C}) \begin{bmatrix} -\text{seg} \\ -\text{glot} \\ -\text{FB} \end{bmatrix}$$

(7) THREE SYLLABLE SEGMENTATION (adjustment)

$$+ \longrightarrow \cdot / \left\{ \begin{array}{l} \# \\ \text{C} \end{array} \right\} \text{CV} ______ [+ \text{dist}] \text{V} [- \text{dist}] \text{V} (\text{C}) \begin{bmatrix} -\text{seg} \\ -\text{glot} \\ -\text{FB} \end{bmatrix}$$

(8) THREE SYLLABLE SEGMENTATION (optional adjustment)

$$+ \longrightarrow \cdot / \text{C.CV} ______ [+ \text{dist}] \text{VCV} (\text{C}) \begin{bmatrix} -\text{seg} \\ -\text{glot} \\ -\text{FB} \end{bmatrix} \text{ OPT}$$

(9) FORMATIVE BOUNDARY DELETION

$$+ \longrightarrow \emptyset$$

(10) PRIMARY PROMINENCE PLACEMENT

$$[-\text{stress}] \longrightarrow [1 \text{ stress}] / \# (\text{C}) \left[\text{---V} \right]$$

(11) SECONDARY PROMINENCE PLACEMENT

$$[-\text{stress}] \longrightarrow [2 \text{ stress}] / \cdot \text{C} ______ [+ \text{seg}]$$

(12) PROMINENCE SHIFTING

$$\begin{bmatrix} -\text{low} \\ \alpha \text{stress} \end{bmatrix} \begin{bmatrix} +\text{voice} \\ 1 \end{bmatrix} \begin{bmatrix} +\text{low} \\ 2 \end{bmatrix} \rightarrow \begin{bmatrix} 1 \\ -\text{stress} \end{bmatrix} 2 \begin{bmatrix} 3 \\ \alpha \text{stress} \end{bmatrix} \text{ OPT}$$

where $\alpha = 1$ or 2

(13) REGRESSIVE GEMINATION

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

where $\alpha, \beta, \gamma = +$ or $-$, and $\delta = 1$ or 2

(14) GLOTTAL AS PROMINENCE IN DURATIVE

$$\begin{matrix} [1 \text{ stress}] \\ 1 \end{matrix} \begin{bmatrix} -\text{seg} \\ -\text{glot} \end{bmatrix} \begin{matrix} \\ 2 \end{matrix} \xrightarrow{\text{DA}} \begin{bmatrix} 1 \\ -\text{stress} \end{bmatrix} \begin{bmatrix} 2 \\ +\text{glot} \end{bmatrix}$$

(15) SCHWA³³

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

(16) VOWEL ELISION

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

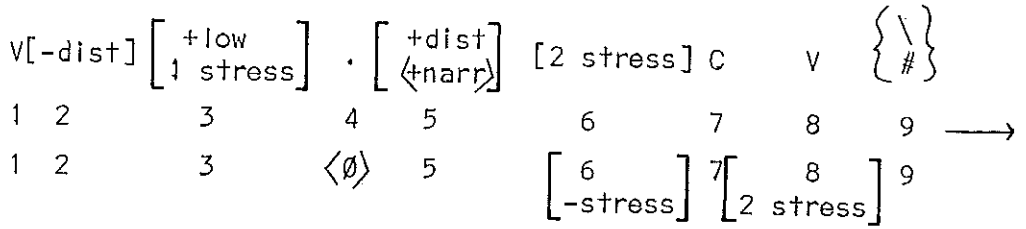
(17) CLASS 111 VERB PATTERN CHANGE (optional)

$$\begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \end{matrix} \begin{matrix} \text{C} . \text{C} [-\text{back}] . \\ \begin{bmatrix} +\text{dist} \\ -\text{periph} \\ -\text{son} \\ +\text{voice} \end{bmatrix} \\ \begin{bmatrix} -\text{back} \\ 2 \text{ stress} \end{bmatrix} \\ \begin{bmatrix} +\text{dist} \\ -\text{periph} \\ -\text{son} \\ +\text{voice} \end{bmatrix} \\ [-\text{back}] \end{matrix} \left. \begin{matrix} \\ \\ \\ \end{matrix} \right\} \text{OPT}$$

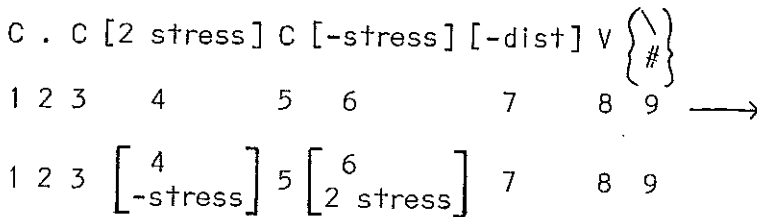
$$\begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \end{matrix} \begin{matrix} \begin{bmatrix} 2 \text{ stress} \end{bmatrix} \\ \emptyset \\ \begin{bmatrix} +\text{narr} \end{bmatrix} \\ \begin{bmatrix} -\text{stress} \end{bmatrix} \\ \cdot \\ \begin{bmatrix} 2 \text{ stress} \end{bmatrix} \end{matrix}$$

Rule 17 permits a word such as /ku₁t₂i₃d₄j₅i₆d₇i₈/ 'be sated' to be articulated either as ['ku₁t₂.t₃i₄.d₅j₆i₇d₈] or as ['ku₁t₂.t₃ʔ₄yi₅.d₆ʔ₇]. Both of these patterns are common, particularly the latter one; for example /bi₁ř₂m₃ř₄i₅d₆i₇/ ['bi₁ř₂.m₃ř₄i₅.d₆ʔ₇] 'sing'

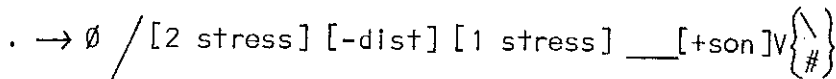
(18) COALESCENCE (four syllables)



(19) ALTERNATION ADJUSTMENT 1

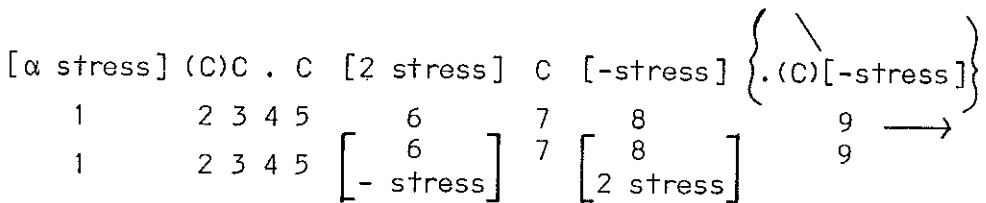


(20) COALESCENCE (three syllables)



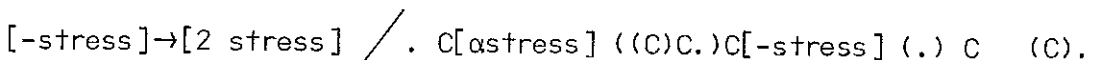
(Rule 20 could be ordered before rule 19)

(21) ALTERNATION ADJUSTMENT 2



where $\alpha = 1$ or 2

(22) ALTERNATION ADJUSTMENT 3



where $\alpha = 1$ or 2

(23) PRE-PAUSE PROMINENCE

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

(24) VOWEL BACKING

$$[-\text{back}] \rightarrow [+back] / \left[\begin{array}{l} +\text{periph} \\ -\text{cont} \\ \alpha\text{back} \end{array} \right] \text{---} \left[\begin{array}{l} +\text{periph} \\ -\text{cont} \\ -\alpha\text{back} \end{array} \right] [+son] \left\{ \begin{array}{l} \backslash \\ \# \end{array} \right\} \text{OPT}$$

where $\alpha = +$ or $-$

(25) WORD-FINAL VOWEL LOWERING

$$[+\text{high}] \rightarrow [-\text{high}] / \left\{ \begin{array}{l} \# \\ \cdot \end{array} \right\} (\text{C}) [\alpha\text{stress}] (\text{CV})\text{C} ___\#$$

where $\alpha = 1$ or 2

(26) HIGH VOWEL LOWERING BEFORE BOUNDARIES (except "+", see rule 9)

$$[+\text{high}] \rightarrow [-\text{high}] / \left[\overline{\quad} \right] [2 \text{ stress}] [-\text{seg}] \text{ OPT}$$

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

(27) GLOTTAL AS PROMINENCE BEFORE PAUSE

$$\emptyset \rightarrow \left[\begin{array}{l} -\text{seg} \\ +\text{glot} \end{array} \right] / [2 \text{ stress}] \text{---} \backslash \text{ OPT}$$

(28) VOWEL LENGTHENING BEFORE PAUSE

$$[2 \text{ stress}] \rightarrow [+long] / \text{---} \backslash \text{ OPT}$$

(29) VOWEL LENGTHENING BY PROMINENCE

$$[-\text{long}] \longrightarrow [+ \text{long}] / \left[\begin{array}{c} \text{---} \\ 1 \text{ stress} \end{array} \right] \left\{ \begin{array}{c} \# \\ \text{CV} \end{array} \right\}^{34} \text{OPT}$$

(30) HIGH VOWEL LOWERING IN PROMINENT SYLLABLE

$$[+\text{high}] \longrightarrow [-\text{high}] / \left[\begin{array}{c} \text{---} \\ 1 \text{ stress} \end{array} \right] \text{OPT}$$

(31) OBSTRUENT TRUNCATION

$$[-\text{son}] \longrightarrow \left[\begin{array}{c} -\text{voice} \\ +\text{held} \end{array} \right] / \text{---} \left\{ \begin{array}{c} [-\text{seg}] \\ \text{C} \end{array} \right\}$$

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

(32) PROMINENCE REALIZATION AS STRESS

$$[2 \text{ stress}] \longrightarrow [-\text{stress}] / \text{---} [-\text{seg}]$$

(33) WORD BOUNDARY METAMORPHOSIS

$$\# \longrightarrow \cdot / \text{---} [+ \text{seg}]$$

End of cycle.

6.2 REDUPLICATIONS

In section 4.2 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

$$\left[\text{buwal} \left[\text{buwal dji gi} \right] \right]_{\text{verb}} \text{verb}$$

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 words³⁵.

Although durative aspect in a verb will be realized 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 realized as a post-positioned glottal stop after the reduplicated CV which forms the durative morpheme. Presumably the syntax and morphophonemics will handle the reduplication of 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, /ɲu-ɲuri/ 'is sleeping', will be labelled as:

$$\left[\text{verb} \left[\text{DA}^{\text{ɲu}} \right] \text{DA} \left[\text{verb } \text{ɲuri} \right] \right]_{\text{verb}} \text{verb}$$

Providing these conditions are adhered to, the rules of section 6.1 will handle reduplicated forms correctly.

6.3 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 semi-vowels this contrast occurs." (page 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 realizations 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 page 52. He considers certain nominal affixes which he assumes have geminated voiceless stop onsets. The following quote is taken from page 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 (page 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 pages 58 to 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 pages 14 to 17) that a voiceless stop often (but apparently not always) geminates when it follows an open stressed syllable. Hence gemination in both Rembarnga and Djinang appear 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 page 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' and 'C' are accounted for by the cluster segmentation rule (rule 3) of section 6.1. 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 6.1 predict precisely the behaviour outlined in condition 'D'. Examples (from page 53, but changed to my notation and with no marking of secondary stress):

[kutj.pərə.tja] , from kutjperəttja

[pəlp.pəlnətj.tja] , from pəlppəlŋəttja

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 (page 53); and it appears that stress groups may commence with non-distributed consonants (pages 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 (page 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 (page 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 (page 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 3.3)

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 a separate voiced and voiceless series of stops involves "extra complexity" (page 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.

FOOTNOTES

- 1 Yo!ngu, which means "people", is a word used extensively by Aboriginals in north east Arnhem Land to refer to themselves. Murngic languages (Voeglin and Voegelin, 1977:24), which are spoken by people in this area, are often referred to as 'Yo!ngu' 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 Yo!ngu 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 Yo!ngu 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, neutralization 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 neutralized at the start of a word at the beginning of a phrase or clause, while it is uncommon for neutralization 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 has very many more Gupapuyngu words beginning with /d/ 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 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 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 phenomena 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', ['iildje?] 'you' (plur), ['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/ [bɪ'lawile?] 'two'. These will be handled in section 6.1.

- 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 "#" and "+" boundaries. For example: /walmini/ 'crossed over', has the structure #walmi+ni#, but the phonetic realization of it is ['wal.mi.ni?].
- 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 5 and 6.
- 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 5 and 6.
- 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.diře?] 'later l'.
- 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 "?", "\" 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 realizations. 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 , #, .,+. The same authors also discuss the use of "phonological phrase" boundaries (on page 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 neutralization 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 syllables will be [-schwa].
- 34 Long vowels in closed syllables are quite rare. Clear examples are limited to words of form #CVC#. For example: 'ro:m 'way of life', 'law'; 'we:r 'nothing'; 'yol: '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.

APPENDIX: SWADESH 100 WORD LIST

/mapal/	['maɸ.pál]	'hair', 'leaf', 'feather'
/gung <u>i</u> /	['gon.geʔ]	'head'
/djabi <u>ri</u> /	['djabi_re]	'mouth'
/ɲu <u>ři</u> /	['ɲořeʔ]	'nose'
/mi <u>l</u> /	['me:l]	'eye'
/gur <u>aki</u> /	[gu'raċ.keʔ]	'nape of neck'
/ma <u>ni</u> /	['ma:neʔ]	'front of neck', 'throat', 'river'
/bud <u>jiři</u> /	['bo:djiřeʔ]	'stomach'
/giling <u>ka</u> /	['giling.ká]	'skin'
/ma <u>lk</u> /	['maċ]	'skin'
/bun <u>diři</u> /	['bon.diřeʔ]	'knee'
/yu <u>l</u> /	['yo:l]	'man', 'person'
/miy <u>ilk</u> /	['miyilk]	'woman'
/wu <u>rgi</u> /	['wor.geʔ]	'bird'
/bu <u>tjiy</u> /	['botʃ.tjfy]	'dog'
/di <u>řadjili</u> /	[di'řa.djileʔ]	'he bites', 'eats', 'drinks'
/ni <u>ni</u> /	['niineʔ]	'he sits'
/d <u>ji-tjaři</u> /	[djiʔ'tjaře]	'he stands' (durative)
/ɲu <u>řidji</u> /	['ɲoři.djiʔ]	'he lies' (reclines)
/gi <u>ri</u> /	['gireʔ]~['kireʔ]	'he walks'
/gad <u>ji gař</u> /	['gadji.gář]	'path' (road)
/ři <u>řkiyaň</u> /	['řiř.kiyaň]	'stone'
/wa <u>na</u> /	['wanaʔ]	'big'

/ninin/	['ni:nin]	'small'
/djuŋgi/	['dʒoŋ.geʔ]	'fire', 'wood', 'tree'
/ŋawiřk/	['ŋa:wířk]	'smoke'
/gibilbal/	['gibil.bál]	'ashes'
/butjiri/	['bof].tjireʔ]	'ear', 'horn'
/djilaŋ/	['djilaŋ]	'tongue'
/diřpal/	['diř.pál]	'tooth'
/biri/	['bereʔ]	'breast', 'chest'
/gumbiři/	['gom.biřeʔ]	'hand', 'claw'
/nu/	['no:]	'foot', 'root'
/waliř/	['waliř]	'sun'
/djařibiř/	['djaři.bíř]	'afternoon sun'
/raŋgu/	['raŋ.goʔ]	'moon'
/kaťa/	['kať.taʔ]	'large star'
/guditjimař/	['godi.tjimář]	'small star'
/ginimbiři/	['ginim.biře]	'cloud'
/mayuřk/	['mayuřk]	'rain'
/djuřumuk/	['djuřu.múk]	'rain'
/gapi/	['gař.peʔ]	'water'
/mundjal/	['mon.djál]	'meat'
/maypal/	['may.pál]	'meat'
/gułtji/	['gu].tjeʔ]	'fat'
/giyi/	['geřeʔ]	'egg'
/iřiň guŋili/	['eřiň.'goŋile]	'he gives it to me'
/ňaŋini/	['ňaŋineʔ]	'he sees'

/bi ki <u>ri</u> mi/	[bi'ki <u>ri</u> .meʔ]	'he comes'
/mimi/	['me <u>me</u> ʔ]	'louse'
/wur <u>pmi</u> /	['wur <u>p</u> .meʔ]	'one'
/bi <u>ngi</u> li/	['be <u>ŋ</u> .gi <u>le</u> ʔ]	'two'
/du <u>rk</u> du <u>rk</u> /	['du <u>r</u> k'. <u>du</u> r <u>k</u>]	'heart'
/mi <u>d</u> mi <u>d</u> i/	['mi <u>d</u> i'. <u>mi</u> d <u>i</u>]	'liver'
/ŋi <u>r</u> ki/	['ŋi <u>r</u> .keʔ]	'bone'
/bu <u>d</u> i/	['bo <u>d</u> eʔ]	'blood'
/mi <u>m</u> an/	['me <u>m</u> an]	'tail'
/ya <u>r</u> ti/	['ya <u>r</u> . <u>te</u> ʔ]	'tail'
/ya <u>gi</u> ri/	['ya <u>gi</u> riʔ]	'name'
/gu <u>y</u> i/	['go <u>y</u> eʔ]	'fish'
/mu <u>na</u> tja/	['mu <u>na</u> .tjaʔ]	'sand', 'earth'
/bu <u>k</u> i/	['bo <u>k</u> .k <u>f</u>]	'mountain'
/ba <u>mbu</u> li/	['bam.bo <u>le</u>]~['bam.bo <u>le</u> ʔ]	'bark'
/wu <u>ř</u> ki/	['wu <u>ř</u> .keʔ]	'seed'
/ma <u>li</u> ri/	['ma <u>li</u> riʔ]	'night'
/ba <u>rd</u> ji <u>ni</u> ŋ/	['ba <u>r</u> .d <u>ji</u> niŋ]	'white'
/mu/	['mo:ɪ]	'black'
/bu <u>t</u> ja <u>la</u> k/	['bo <u>t</u> .t <u>ja</u> la <u>k</u>]	'yellow'
/mi <u>k</u> i/	['me <u>k</u> .keʔ]	'red'
/bu <u>ta</u> l/	['bo <u>t</u> .t <u>al</u>]	'good'
/gi <u>li</u> wi <u>li</u> ŋ/	['gi <u>li</u> .wi <u>li</u> ŋ]	'long'
/mi <u>n</u> /	['mi <u>n</u>]	'cold'
/mu <u>ru</u> mu <u>ri</u> ŋ/	['mu <u>r</u> . <u>mu</u> ri <u>ŋ</u>]	'warm', 'hot'

(the [ʔ] is a transition segment only)

/yowi <u>ri</u> djiŋ/	['yowi <u>ri</u> .dʒiŋ]	'new'
/galbi/	['gal.biʔ]	'many'
/wařapam/	['wařa.pám]	'all'
/dʒiniŋ/	['dʒiniŋ]	'this'
/dʒinim/	['dʒinim]	'this' (not near to hand)
/ŋunuŋ/	['ŋunuŋ]	'that'
/ŋunum/	['ŋunum]	'that' (over there)
/wari/	['wareʔ]	'who?'
/wi <u>t</u> ñi <u>ri</u> ŋ/	['wi <u>t</u> .ñi <u>ri</u> ŋ]	'round'
/buřdjiŋ/	['buř.dʒiŋ]	'dry' (clothing)
/dulpi/	['dol.peʔ]	'full'
/gutum/	['guř.túm]	'full'
/iŋki/	['iŋ.kiʔ]	'not', 'no'
/wiř/	['weř]~['we:ř]	'none!', 'no'
/ñani waŋini/	['ñani.'waŋineʔ]	'he says'
/mařiŋini/	['maři.ŋineʔ]	'he hears'
/mar <u>a</u> ŋi/	['mar <u>a</u> .ŋiʔ]	'he knows'
/yakiřidʒin/	['yaķ.kiři.dʒiŋ]	'he sleeps'
/ŋuřiñin/	['ŋoři.ñiŋ]	'he sleeps'
/bumi/	['bomeʔ]	'kill!', 'make'
/balini/	['balineʔ]	'he dies'
/buřdʒiři/	['buř.dʒiřeʔ]	'it burns' (fire)
/nundʒiřali/	['nun.dʒiřále]	'it flies'
/yigilim/	['yigilim]	'he swims'

/ŋaʃi/

['ŋaʃeʔ]

'I'

/ñuni/

['ñoneʔ]

'you'

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