Vowel Phonotactic Positions in Australian Aboriginal Languages
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0. Introduction.

In the definitive overview of Australian phonotactics in Dixon (1980:159-178) the focus is on the phonotactic positions of consonants. Dixon uses the labels for the consonantal phonotactic positions within the word shown in (1).

(1) Descriptive word templates in Australian (Dixon 1980).
$C_{init}VC_{inter}V(C_{fin})$
$C_{init}VC_1.C_2V(C_{fin})$

Each of the five different consonantal positions show distinct phonotactic patterns. As discussed by Dixon, consonants in word-initial position (C_{init}) and consonants in the second position of a word-internal heterorganic cluster (C_2) show similar, though distinct, phonotactic constraints; similarly, word-final (C_{fin}) consonants and consonants in the first position of a heterorganic cluster (C_1) show similar phonotactics. Dixon observes that in the former two positions labial and dorsal segments have a preferential distribution over coronals, while the opposite pattern obtains in the latter two positions. Intervocalic position, C_{inter}, stands out as the only structural position in the word where consonantal contrasts are unconstrained and all of the consonants in the inventory of the language in question are in contrast.

What is lacking in Dixon's discussion of Australian phonotactics is the fact that there are distinct vocalic phonotactic positions within the word. This is the topic of this paper. As I will show, there are two distinct positions of neutralisation. These are word-initial position, discussed in section 1, and word-final position, discussed in section 2. Metrical anomalies of word-edge vowels are discussed in section 3, and these are offered as further evidence of the special phonotactic status of word-initial and word-final vocalic positions. Finally, there is a unique vowel position in the word which stands out as the site of maximal contrast. This is the first post-consonantal vowel, a position which I label the *Focus Vowel*. In this position all of the vocalic contrasts present in the language are active, whether they are permitted in non-focus positions in the word or not. Discussion and motivation of the Focus Vowel position is in section 4, followed by concluding discussion in section 5.

1. Word-initial vowel phonotactics.

It is the majority pattern in Australian Aboriginal languages that words are required to begin with a consonant, as expressed in the word templates given in (1). There is, however, a significant minority of languages which allow vowel-initial words. In some of these languages the vowel-initial words

constitute a very small portion of the lexicon while in others the lexicon is either predominantly or exclusively vowel-initial. Aboriginal languages which permit vowel-initial words normally do not permit word-medial vowel-initial syllables.

Among languages which permit vowel-initial words, it is frequently the case that the set of vowels which contrast in initial position is only a subset of the vowel inventory of the language. This is a very common, almost typical, pattern, especially (though not exclusively) in the languages where only a minority of the lexicon is V-initial. It is certainly the case that no language has more vowel contrasts in word-initial than in other phonotactic positions. In cases of a disparity in the vowels in initial and non-initial positions, low vowels enjoy a favoured status. This is shown in the fact that they are more likely to be permitted than non-low vowels in initial position. The statistical predominance of the low vowel mentioned for Alyawarra and Atampaya Uradhi mentioned above reinforces this observation. A vowel length contrast is typically also not licensed in word-intial position.

The language Mbabaram (Dixon 1991) is an example. This language has six distinctive vowel qualities as well as contrastive length. The Mbabaram vowel phonemes are displayed in (2.a) along with some data illustrating vocalic contrasts (2.b). In spite of the rich inventory of vowels which Mbabaram enjoys, only one of these vowels, with no length contrast, is permitted in word-initial position (2.c). This is the vowel /a/.

(2)a.	Mbabaram		
	i, iː	ɨ, ɨː	u, uː
	ɛ, ɛː	a, aː	ɔ, ɔː
b.	nɔːmbɨ		big red wallaroo
	gɛy		sand goanna
	muɽaːl		cold
	nambuːɽ		big brown snake
	guriḏal		eagle hawk
	gɨ		tree
c.	albɔ		egg
	alŋgida		downhill
	aŋgʷayir		hungry
	araman		woomera
	*aːCVC, *iCVC, *ɔCVC etc.		

The bias in favour of the low vowel is typical. The general pattern in languages that allow V-initial words is that it is only the low vowel or vowels in the inventory which may occur initially. In languages with either the three-vowel system, as in Anindilyakwa (3.a), and the five-vowel system, such as Marra and others (3.b), the single low vowel is often the only one permitted.

In four vowel inventories, word-initial position is often ristricted to either only one (3.c) or both (3.d) of the low vowels.

(3)a. Anindilyakwa (Leeding 1989:62)

Vowels which contrast C__C	Vowels which contrast #__C
i u	
a	a

b. Marra (Heath 1981); Ngalakan (Merlan 1983:11); Ngandi (Heath 1978); Warndarang (Heath 1980b).

Vowels which contrast C__C	Vowels which contrast #__C
i u	
e o	
a	a

c. Tiwi (Lee 1987:30)

Vowels which contrast C__C	Vowels which contrast #__C
i u	
a o	a

d. Alawa (Sharpe 1972:22); Ngan'gityemerri (Reid 1990:69).

Vowels which contrast C__C	Vowels which contrast #__C
i u	
e a	e a

Another example of the special status of the low vowel is shown in Nunggubuyu. In this language the length contrast is licensed for only the low vowel in word-initial position, although the two non-low vowels show contrastive length in other positions (3.e). A combination of preference for low vowels as well as the lack of a length contasts is shown in the word-initial vowel phonotactics of Kitja (3.f). Kitja has four contrastive vowel qualities, as well as a length contrast active for only the low vowel /a/. But initially in Kitja only the low vowel occurs, and its length contrast is neutralised.

(3)e. Nunggubuyu (Heath 1984:17)

Vowels which contrast C__C	Vowels which contrast #__C
i, i: u, u:	i u
a, a:	a, a:

f. Kitja (Taylor & Taylor 1971:107)

Vowels which contrast C__C	Vowels which contrast #__C
i ɨ u	
a, a:	a

An extreme case of positional neutralisation of phonemic contrasts for vowels in initial position is the Mpakwithi dialect of Anguthimri. This language

contrasts seventeen vowels, constituting the largest vowel inventory in Australia. In V-initial words, however, only the cardinal vowels /i, a, u/ contrast in initial position (3.g).

(3)g. Mpakwithi Anguthimri (Crowley 1983)

Vowels which contrast C__C		Vowels which contrast #__C	
i, iː, ĩ, ü	u, uː	i	u
e, eː, ẽ, ö	o		
æ, æː, ãæ	a, aː, ã		a

To summarise to this point, in many Australian Aboriginal languages which permit vowel-initial words only a subset of the phonemic vowel contrasts exploited in the language are licensed initially. This is the case for both vocalic quality and quantity contrasts. In the case of quality neutralisation, there is strong preference for low vowel(s) in this position.

2. Word-final vowel phonotactics.

The other word-edge, word-final position, is also unable to license the full range of vowel contrasts that are permitted medially. A comparison of Australian languages reveals that in this position the quantity contrast is more robustly impoverished than the quality contrasts. For example, Kuuku Yaʔu has the vowel inventory shown in (4.a), which includes contrastive length as demonstrated by the (near-) minimal set in (4.b). The length contrast is permitted in all syllables (4.c), including the word-final syllable in consonant-final words (4.d), but not for vowels in word-final position (4.e).

(4)a. Kuuku Yaʔu

Vowels which contrast C__C		Vowels which contrast C__#	
i, iː	u, uː	i	u
a, aː		a	

b.	ŋaʈina	find
	ŋaːʈina	laugh
	yaːʈiːna	call out
c.	t̪uːlu	grass tree
	wiːmumu	large number of ants
	wiyaːna	another
	tawuraːlu	with a knife
	muːmaːŋa	rub
d.	kulaːn	possum
e.	t̪uːlu, *t̪uluː	

Both Atampaya Uradhi (5.a) and Mpakwithi Anguthimri (5.b), which have relatively rich vowel inventories, fail to license vowel length in word-final

position, similar to Kuuku Ya?u. These languages also do not contrast the full range of lexical vowel qualities word-finally.

(5)a. Atampaya Uradhi (Crowley 1983)

Vowels which contrast C__C		Vowels which contrast C__#	
i, iː	u, uː	i	u
e, eː	a, aː		a

b. Mpakwithi Anguthimri (Crowley 1981)

Vowels which contrast C__C		Vowels which contrast C__#	
i, iː, ĩ, ü	u, uː	i, ĩ	u
e, eː, ẽ, ö	o	e, ẽ	
æ, æː, æ̃	a, aː, ã		a, ã

From the discussion of vowel phonotactics in these two sections, and the discussion of consonant phonotactic positions by Dixon 1980, it is clear that the word-edge positions, for both consonants and vowels, are unable to license the full set of phonemic contrasts permitted in the language.

3. Metrical considerations in the special status of word-edge vowels.
Another symptom of the fact that word-edge positions are defective for vowels is that in many languages word-initial and -final vowels are metrically anomalous. In these languages word-edge vowels are unable to bear stress. The majority pattern in Australian languages is that primary stress falls on initial syllables, but in many languages which allow vowel-initial words, stress falls on the first post-consonantal vowel. Put another way, stress fall on the first syllable with an onset; word-initial vowels are unable to carry stress. Most of the languages of the Arandic group are like this, including Alyawarra (Yallop 1977) and Andegerebenha (Breen 1977:374). Stress falls on the first syllable in C-initial words (6.a) and on the second syllable in V-initial words (6.b). Data here are from Alyawarra.

(6)a.	kwáʈa	water, rain, urine
	ríṉa	3.sg.ACC
b.	aṯá	1.sg.ERG
	a̠mpá	child
	ilípa	traditional stone axe
	arákiʈa	mouth

The same pattern obtains in Mbabaram (Dixon 1991:360). Stress in Mbabaram is quantity-sensitive--long vowels necessarily attract primary stress--and, as discussed above, contrastive vowel length is not licensed in word-initial position. However, even in words with no long vowels stress never falls on a word-initial vowel (7.a).

(7)	albɔ́	egg
	arbáy	sharp
	alŋgída	down hill
	aráman	woomera

Word-initial vowels are doubly-defective in Mbabaram: in this position all of the contrasts for vowel quality are neutralised as well as the length contrast, in addition to the fact that the position is unable to carry stress.

The parallel pattern for word-final vowels being unable to bear stress is attested in Wemba-Wemba (Hercus 1969:23) and Wergaia (Hercus 1969: 118). In these languages primary stress falls on the initial syllable and secondary stress falls on the third syllable in three- and four-syllable words. Therefore word-final syllables receive secondary stress in trisyllabic words, but only when the word is consonant-final (8.a). In trisyllables which end in a vowel, the final vowel is unable to bear secondary stress (8.b). Data here are from Wemba-Wemba.

(8)a.	ɖínəɲùk	his foot
b.	búrganda	I am sighing
	*búrgandà	

A similar pattern is attested in Djabugay (Patz 1991). In Djabugay stress assignment is sensitive to the quantity of the nucleus. This is shown by the fact that stress is normally on the initial syllable in words with only short vowels (9.a) but will be on a non-initial syllable in words with an internal long vowel (9.b). In consonant-final words a long vowel in the final syllable will attact stress as well (9.c), but a word-final long vowel does not attract stress, and thus is treated as if it were short (9.d). This pattern gives rise to the stress alternations in suffixed forms, where adding a suffix to a form with a final long vowel makes it visible to the quantity sensitive stress rule and thus allowing it to attract stress (9.e).

(9)a.	bína	ear
	búluru	name of creator figure
	gúruŋga	kookaburra
b.	wuɽú:ril	to take out
	bundá:ra	cassowary
c.	guljá:y	these
	guɖá:y	those
d.	ɖína:	foot
	wúɽu:	river
e.	ɖiná:-la	foot-LOC/INST
	wuɽú:-la	river-LOC

This pattern of word-edge vowels being metrically defective reinforces the segmentally defective nature of vowel positions at word-edges that I demonstrated earlier in the previous two sections.

4. The Focus Vowel.

There is one more structural position which is singled out as having special phonotactic status in Australian languages, and this is the vowel following the first consonant (or consonant cluster) of the word. In languages with only C-initial words this always corresponds to the nucleus of the first syllable. In languages which allow vowel-initial words, the nucleus of the first onsetted syllable has this status. I will refer to this special vocalic position as the *Focus Vowel*. This position has already been singled out as being the position where word-stress is assigned in the majority of Australian languages. (I will discuss the relationship between stress and the Focus Vowel in the following section.)

Ritharngu (Heath 1980a) is a C-initial language and therefore the Focus Vowel corresponds to the nucleus of the initial syllable. Ritharngu contrasts long and short vowels, but only in initial syllables (Heath 1980a:11). There is no prefixal morphology in this language, and so word-initial syllables are also root-initial. There are instances of roots with an underlying long vowel ending up in a non-initial syllable in compounding and reduplication. In such cases the second long vowel is shortened (Heath 1980a, 12-13) (10.b).

(10)a. Ritharngu

Focus Vowel position		Non-Focus Vowel position	
i, iː	u, uː	i	u
a, aː		a	

b.

d̪aːra-	to stand
ɖumɖum?-d̪ara-	to bend over
d̪aːra?-d̪ara-	all to stand

Just as a vowel length contrast is often only attested in the Focus Vowel, some languages also show vowel quality contrasts only in the Focus Vowel. This is attested in the Cape York initial-dropping language Kuku-Thaypan (Rigsby 1976). The vowel inventory for this language is shown in (11). In C-initial words these vowels contrast in the first syllable and in V-initial words they contrast in the second syllable. Vowels in other structural positions in words, including word-initial vowels, are non-contrastive. These are written as /a/.

(11)a. Kuku-Thaypan

Focus Vowel position			Non-Focus Vowel position
i	ɨ	u	
e		o	
æ	a	ɔ	a

It will be recalled from discussion in the preceding section that the Focus Vowel is the invariant location of primary stress in many Australian languages. This correlation is likely not completely coincidental, and I return to the topic of the relationship between the Focus Vowel and stress in this section. The question is what exactly is the nature of the relationship between stress and the Focus Vowel.

It could be argued that the special status of the Focus Vowel, as the position of maximum vocalic contrast, derives trivially from the fact that this is the position of primary stress in the majority of Australian languages. This could be accomplished by the neutralisation rule expressed in (12), acting as a morpheme structure rule:

(12) Neutralise specific vowel contrasts in unstressed syllables.

In Ritharngu stress is invariant, always on the Focus Vowel. Therefore the location of the vowel length contrast in this language could be accounted for with reference to the location of word-stress by neutralising the vowel length contrast in unstressed syllables. Note that this type of rule is independently required in Ritharngu as witnessed in the alternations in (10.b). Likewise the Kuku-Thaypan vowel phonotactics could be accounted for by a rule such as (12) neutralising all vowel quality contrasts in unstressed syllables.

One potential problem with such a rule would be that rules should not be able to refer to the absense of a feature such as stress. To make allowance for this it could be assumed that a well-formedness condition exists requiring specific vowel contrasts to be licensed by stress (see Dresher & van der Hulst 1993). This condition could then act as a morpheme structure constraint as well as trigger rule (12) in morphologically complex forms. Either way, the empirical content of this rule in Ritharngu would be the attested location of the length contrast only in the stressed syllable. In this type of approach there is a direct relationship between the Focus Vowel and the location of stress, with the special phonotactic status of the Focus Vowel deriving trivially from metrical structure.

The advantage of this type of approach is that it collapses two positions, the Focus Vowel and the location of word-stress, into one, and thus avoids resorting to coincidence to explain the intersection of the Focus Vowel and the location of stress. But the special status of the Focus Vowel is independently motivated in Australian, and I will demonstrate this in Warrgamay (Dixon 1981). The same pattern discussed here for Warrgamay is also attested in Nyawaygi (Dixon 1979). Warrgamay is a C-initial language, and therefore the Focus Vowel always corresponds to the nucleus of the word-initial syllable. Warrgamay is like Ritharngu in that it has a length contrast for vowels (13.b) which is only attested in the Focus Vowel position (Dixon 1981). In contrast with Ritharngu, however, which has an invariant pattern of word-

stress on the Focus Vowel, Warrgamay stress varies predictably between the first and second syllables. The facts are as follows. In words with a long vowel (which can only occur in the initial syllable), this receives stress (13.c). Stress is also initial in words with an even number of syllables (13.d), whether the first vowel is long or short. The variation from the strict initial stress pattern comes in words with no long vowel and an odd number of syllables, in which case stress falls on the second syllable (13.e). This produces alternations where stems with an even number of syllables take a mono-syllabic suffix triggering shift of stress from the first to the second syllable (13.f).

(13)a. Warrgamay

	Focus Vowel position		Non-Focus Vowel position	
	i, i:	u, u:	i	u
	a, a:		a	
b.	ganda-		to burn, cook	
	ga:nda-		to crawl	
c.	mú:ba		stone fish	
	gí:baɽa		fig tree	
d.	báda		dog	
	gíɖawùlu		freshwater jewfish	
e.	gagára		dillybag	
	ɖuɽágay-mìri		Niagara vale-FROM	
f.	múŋan		mountain	
	muŋán-da		mountain-LOC	

A vowel length neutralisation rule conditioned by stress, as in (12), as an account of the distribution of the vowel length contrast is impossible for Warrgamay. First, since the second syllable in trisyllabic roots receives stress, and the neutralisation rule (12) by definition cannot apply until after the stress rule, a hypothetically possible length contrast would be licensed by stress in this position. Therefore this approach leaves unexplained why there is no length contrast for the second syllable in trisyllabic roots. Second, since stress is obviously quantity- sensitive in Warrgamay, hypothetical long vowels in non-initial syllables should attract stress and then be protected from the neutralisation rule. It is clear that the phonological pattern in Warrgamay is that there are no long vowels in non-initial syllables *before* the application of the stress rule. Therefore the special phonotactic status of the Focus Vowel position is motivated in Australian Aboriginal languages independently of information derived solely from metrical structure.

5. Concluding discussion.

There are interesting differences and similarities between the phonotactics of consonants and vowels in Australian. First, for consonants the position of

maximum contrast is intervocalic position, C_{inter}, while the position of maximum contrast for vowels is the Focus Vowel. The difference here is that a word may contain more than one or even several C_{inter} slots, but a word can only have one Focus Vowel. This difference derives from the fact that C_{inter} is defined strictly in segmental terms--the vocalic environment--while the Focus Vowel is defined in relation to a unique morphological boundary.

An important similarity is that for both consonants and vowels word edges are positions of neutralisation. Trubetzkoy observes that both word-edges as positions of neutralisation, and adduces evidence from both consonant and vowel phonotactics to demonstrate this (Trubetzkoy 1939/1969:235). Acoustic phonetics may provide some insight into why consonants are neutralised at word edges, particularly in terms of their place contrasts. In acoustic terms, the place of articulation of a consonant is signalled by the contour in the formant patterns in the adjacent vowel(s). The fact that vowels play a crucial role in the saliency of consonantal contrasts provides an acoustic account of why consonants are restricted at word-edges (as well as in consonant clusters) while consonants in intervocalic position do not. The full range of possible phonological contrasts occur in the phonotactic position where the contrasts are most salient, i.e, between vowels. In environments where phonological contrasts may be less salient, predictability is encoded into the system constraining the set of permitted contrasts. All of this relates to recent work by Donca Steriade (1993, 1994) indicating that positions where phonological contrasts are not exploited are positions where the acoustic cues for those contrasts are relatively weak. Complementary work by Ohala and others (see Ohala 1990 and references therein) indicates that phonological contrasts undergo historical reduction in environments where they are not acoustically salient. Similarly, recent work in the perception of vocalic contrasts suggests that the consonantal context play an important role. For example, vowels in a /CVC/ context are more successfully identified than in a /#V#/ context. (See the overview in Rosner & Pickering 1994:319-331). Therefore a perceptual deficit inherent in word-edges may be responsible for the neutralisation of both consonantal and vocalic contrasts in edge positions.

One final point is that there is a fair amount of overlap between the vowel phonotactic positions illustrated here for vowels in Australian languages and those attested in languages outside of Australia. Telugu contrasts five vowel qualities plus contrastive length, /i, iː, e, eː, a, aː, o, oː, u, uː/, except in word-final position where only four of the qualities, with no length contrast, /i, e, a, u/, are permitted (Sastry 1972). Trubetzkoy (1939/1969:235) observes that the length contrast for vowels is neutralised in final position in German, Dutch, English, Norwegian, and Swedish; in Czech it is neutralised in initial position. Also, the word-initial syllable has a special phonotactic status in many languages as a position of maximum vocalic contrast, a fact which partially parallels the Focus Vowel position in Australian. Several Altaic languages

license vowel rounding contrasts in initial syllables that are not permitted elsewhere in words: Vogul, Bashkir and Ostyak allow round vowels only in initial syllables. In Turkish, another Altaic language, both the high and low vowels contrast for rounding in initial syllables but only the high vowels do subsequently in the word. In Yokuts, an American Indian language of California, round vowels can only occur in non-initial syllables only when the vowel of the initial syllable is round. (See discussion and analysis of these facts in Steriade 1994, as well as references cited there.)

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