

Vowels in the Barunga variety of North Australian Kriol

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Abstract

North Australian Kriol is an English based creole spoken widely by Indigenous people in northern Australia in areas where the traditional languages are endangered or no longer spoken. This paper offers the first acoustic description of the vowel phonology of Roper Kriol, within a variety spoken at Barunga Community, east of the town of Katherine in the Northern Territory.

Drawing on a new corpus for Barunga Kriol, the paper presents analyses of the short and long monophthongs, as well as the diphthongs in the spontaneous speech of young adults. The results show the durations and spectral characteristics of the vowels, including major patterns of allophony (i.e. coarticulation and context effects). This updates the phonology over the previous description from the 1970s, showing that there is an additional front low vowel phoneme in the speech of young people today, as well as a vowel length contrast. Interestingly there are points of similarity with the vowel acoustics for traditional Aboriginal languages of the region, for example in a relatively compact vowel space and in the modest trajectories of diphthongs.

Index Terms: language description, vowels, phonetics, Kriol

1. Introduction

North Australian Kriol is an English based creole spoken widely by over 20,000 Indigenous people in northern Australia [1]. It is the first language of children and young adults in many rural and remote areas where traditional languages are no longer spoken or are spoken fluently by elderly people. For the Roper Kriol variety spoken east of Katherine in Australia's Northern Territory, it is now several generations since the language was first described, in the 1970s [2, 3]. In this region, today's young adults are fluent bilinguals in Kriol and in Australian English, and Kriol, as an everyday vernacular language variety, is regionally variable and changing rapidly [4, 5]. Drawing on a new corpus of spontaneous speech, this paper offers an updated description of the vowel phonology in the Barunga variety of Roper Kriol. This complements other recent research on consonant voicing in Roper Kriol at Numbulwar [6] and vowels and consonants in Gurindji Kriol, another local variety in the region [7, 8, 9].

Methodologically the updated description benefits from acoustic analysis and modern phonological insights, both not available to the earlier description. A recurrent observation in the earlier description was of surprising linguistic variability -- within speakers, between speaker generations, and across interlocutor types, especially in the phonology [2, 3]. In light of this possibility, in the present study considerable care was taken with the social context of the field recording situation.

Data are presented here on the speech of the young adult generation, in spontaneous conversation with a familiar Indigenous adult, without the presence of a non-Indigenous English speaking researcher (since the latter tends to result in code-switching towards English).

This paper constitutes the first acoustic description of vowels for any variety of Roper Kriol, and provides a detailed account of the spectral and temporal characteristics of short and monophthongs as well as the trajectories of diphthongs.

2. Vowels in Barunga Kriol

For Barunga Kriol as spoken by young adults, this paper advances our knowledge in relation to three questions: (1) What is the vowel phoneme inventory? (2) What are the acoustic characteristics of the monophthong phonemes, including allophony? (3) What are the acoustic characteristics of the diphthongs? These questions are addressed below in Sections 2.1, 2.2-2.3, and 2.4 respectively.

2.1. Vowel inventory

The existing description [2, 3] proposes a phonemic orthography for Kriol which implies for the Barunga variety a system of five short monophthongs and five diphthongs. Orthographically, these are: i, e, a, o, u, and ai, ei, oi, au, ou. In inventory Barunga Kriol was noted to be similar to the traditional languages of the area which typically have five monophthongs, as opposed to areal languages with three monophthongs.

What is the vowel inventory for Kriol in the speech of today's young people, at Barunga? In this paper we draw on the new speech corpus we have recorded and annotated since 2014 (approximately 50 hours of naturalistic speech, of which just over half is currently transcribed in ELAN/Praat). Based on evidence from minimal (and near-minimal) pairs, there are probably six short vowel phonemes /i, e, ə, æ, ɔ, ʊ/ and five long vowel phonemes (i:, ɜ:, u:, o:, v:):

Table 1: Evidence for vowel monophthong phonemes.

Vowel contrast	Example minimal pair
/i/, /e/	wɪn 'win', wɛn 'when'
/e/, /ə/	wɛn 'when', wɛn 'one, a'
/ə/, /ɔ/	bɛgɪ: 'cart', bɔgɪ: 'swim'
/ɔ/, /ʊ/	gɔd 'God', gʊd 'good'
/ə/, /æ/	bəkɪt 'bucket', bæk 'back'
/e/, /æ/	wɛn 'when', gwænə 'goanna'
/i:/, /ɪ/	fɪ:lɪm 'feel', fɪlmɛp 'fill'
/ɜ:/, /ɛ/	nɜ:s 'nurse', nɛs 'nest'
/v:/, /v/	ʃv:p 'sharp', ʃvɛp 'shop'
/o:/, /ɔ/	ko:s 'course', kɔs 'cost (verb)'

/ʊ:/, /ʊ/	pu:l 'pool', pʊl 'pull'
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In terms of functional load, there are relatively few lexical items which include /æ/: words derived from English words containing /æ/ were historically often reassigned to the /ɛ/ or /ɐ/ categories in Kriol; the emergence of /æ/ seems to be a new feature of young adult speech, not previously described.

2.2. Acoustic analysis methods

The speech sample analysed acoustically in this paper comprises vowel tokens (N=1049; 650 short vowel tokens, 186 long vowel tokens, and 213 diphthong tokens) from our new corpus. All vowel tokens were from the stressed syllable of prosodically prominent content words, in spontaneous speech. For this analysis tokens were from a range of utterance positions (initial, medial, and final), and from both open and closed syllable contexts; although we might expect these factors to influence vowel durations and also formants, for this first analysis of vowels in Barunga Kriol the contextual effects were not analysed separately. Similar numbers of tokens were sampled from five young adult female speakers of Kriol from Barunga, Northern Territory. Speakers were audiorecorded using Olympus LS-14 linear PCM recorder with lapel microphone, at 44.1kHz, 16-bit, in quiet outdoor field conditions, in conversation with a familiar local Aboriginal age-peer from the same community.

Forced alignment using WebMAUS (Italian system) [10, 11] was applied to the audio and orthographic transcription, after using the MAUS Chunking service [12]. In Praat [13], vowel labels and vowel onsets and offsets were manually corrected (with reference to the onset/offset of regular voicing in the waveform and the onset/offset of vowel-related intensity), and acoustic measurements taken.

2.3. Vowel monophthongs

This section presents the acoustic characteristics of the six short and five long monophthongs.

2.3.1. Short monophthongs

Three levels of vowel height (/i, ʊ/, /ɛ, ɔ/ and /æ, ɐ/) are distinguished by midpoint F1 (Figure 1). Overall, the high vowels tend to have F1 values of just under 500 Hz, i.e. a fairly compact vowel space in terms of vowel height.

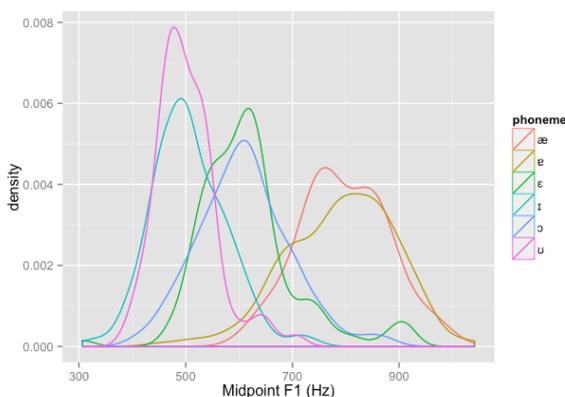


Figure 1: Midpoint F1 (Hz) for short monophthongs.

In midpoint F2 (Figure 2), the back vowels (/ɔ, ʊ) differ from /ɐ/, which differs in turn from the front vowels /æ, ɛ, i/.

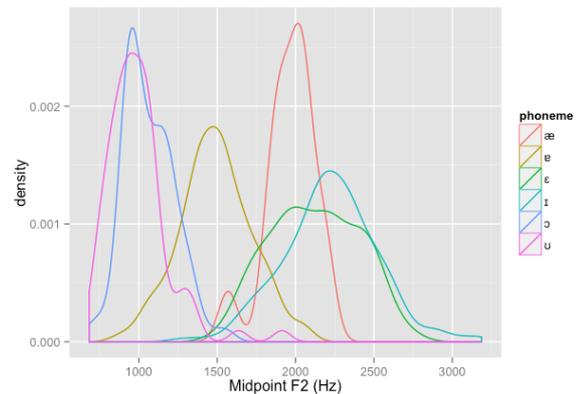


Figure 2: Midpoint F2 (Hz) by short monophthongs.

As shown in Figure 2, the /ɛ/ phoneme has considerable variability in midpoint F2. When analysed by consonantal context, two previously unreported patterns of allophony (coarticulatory or context effects) are clear (Figure 3):

- Tensing (approximately to [e]): /ɛ/ is higher (Figure 4a) and less retracted (Figure 4b) when followed by a voiced coda consonant, e.g. *ben* 'band', *med* 'mad', *prem* 'pram'.
- Lowering (approximately to [æ]): /ɛ/ is sometimes lower (Figure 4a) and sometimes more retracted (Figure 4b) when followed by a lateral, e.g. *telim* 'tell', *helpim* 'help'.

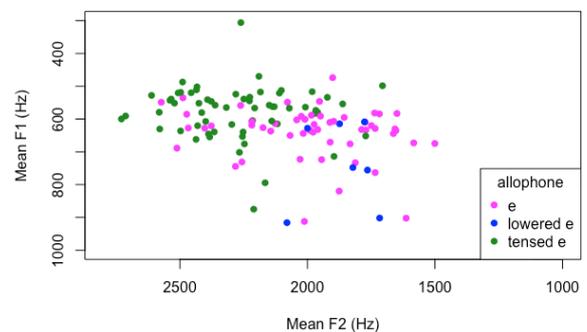


Figure 3: Midpoint F1xF2 (Hz) for /ɛ/ allophones.

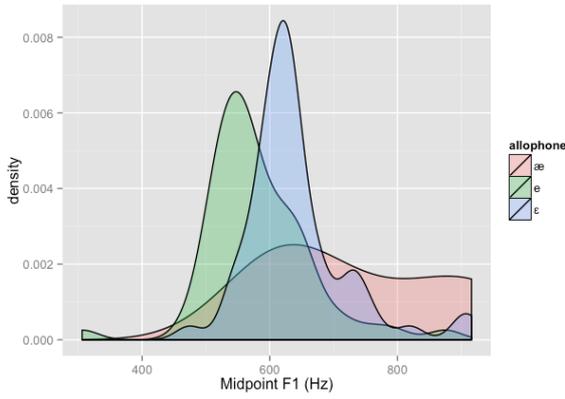


Figure 4a: Midpoint F1 (Hz) for /ε/ allophones.

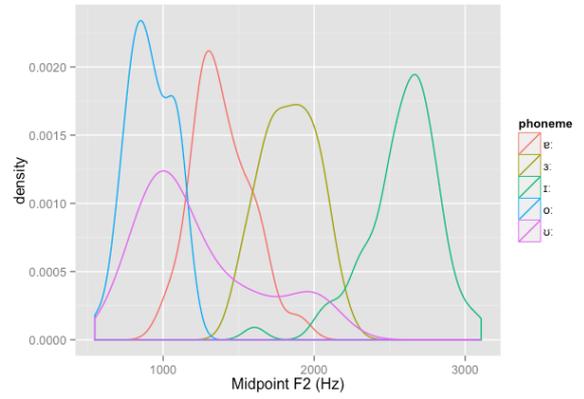


Figure 6: Midpoint F2 (Hz) for long monophthongs.

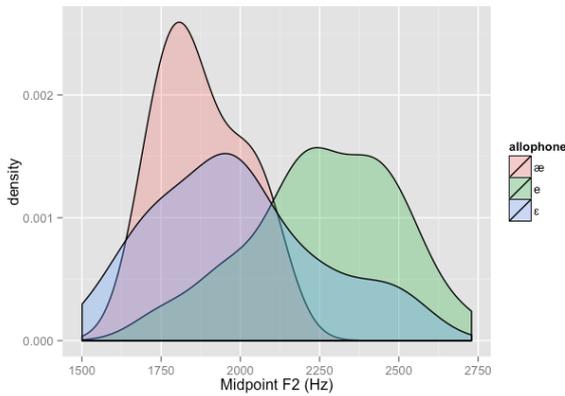


Figure 4b: Midpoint F2 (Hz) for /ε/ allophones.

Spectrally, the phonological long vowels tend to be slightly more extreme (in midpoint F1 and F2) than the short vowels, as can be seen in the comparison of Figures 1 and 2 with Figures 5 and 6.

The vowel tokens analysed in this paper are from spontaneous, running speech, so it is a worthwhile question as to the extent of durational differences between phonologically long and short vowels. In Figures 7a-c are plotted the durations of the high, mid and low monophthongs, respectively; the long vowels tend to have longer durations than the short vowels. There are, however, some tokens with quite large durations regardless of phonological vowel length (these are often in phrase-final position, where vowels are sometimes very elongated especially in storytelling).

2.3.2. Long monophthongs

Three levels of vowel height are distinguished in midpoint F1: /ɪ/, /ɜ:/, /ɛ:/ (Figure 5). There is perhaps particular variation for /ɜ:/ in midpoint F1.

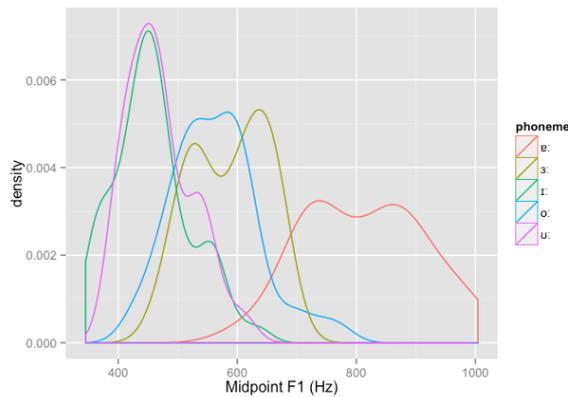


Figure 5: Midpoint F1 (Hz) for long monophthongs.

In terms of midpoint F2, there are four groupings distinguishing /ɪ:/, /ɜ:/, /ɛ:/, and /ɔ:/, /u:/ (Figure 6). There is some midpoint F2 variation in the high vowels /ɪ:/ and /u:/.

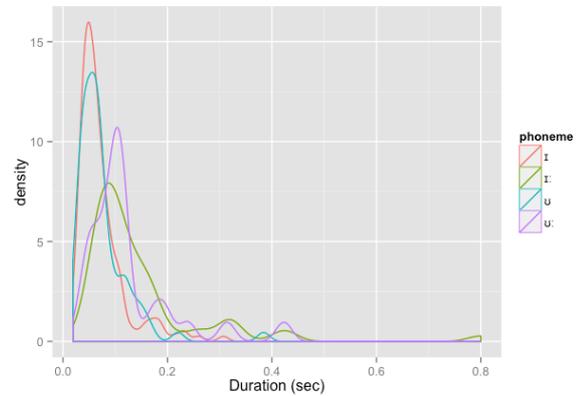


Figure 7a: Duration (in seconds) for high vowels.

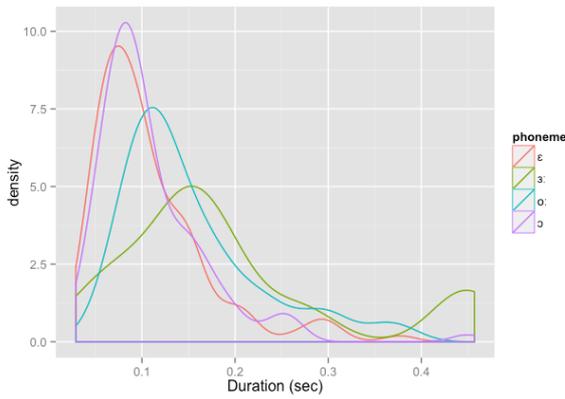


Figure 7b: Duration (in seconds) for mid vowels.

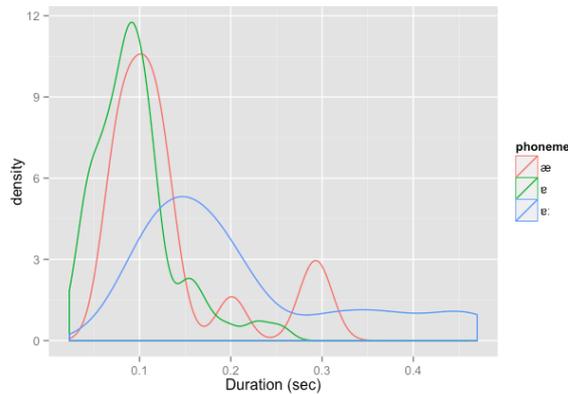


Figure 7c: Duration (in seconds) for low vowels.

2.4. Diphthongs

Figure 8 shows the trajectories (means = solid lines) of the five diphthongs in F1x F2 space (in Hz). Each token is plotted (faint lines) at 20, 35, 50, 65 and 80% of vowel duration.

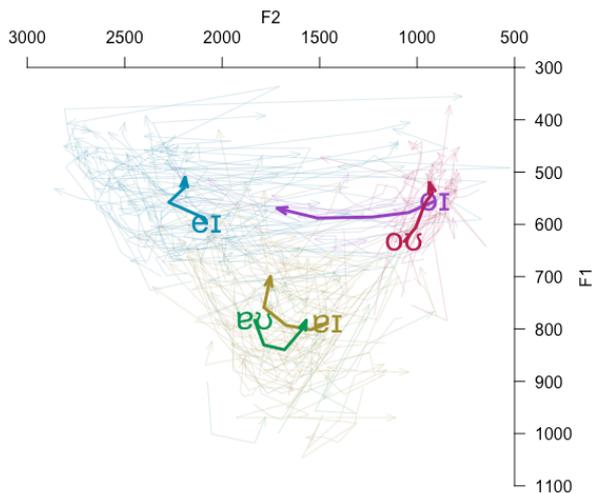


Figure 8: Diphthong trajectories from 20% through 80% of vowel duration (bold=means, faint=tokens).

Individual token trajectories are fairly variable; the tokens are from spontaneous speech. The trajectories are also relatively modest in their spectral movement, with the possible exception of the diphthong /oɪ/.

3. Discussion

The analyses in this paper offer the first quantitative glimpse at the vowel system of Barunga Kriol. On the basis of the phonological and acoustic patterning there would appear to be six short vowel phonemes and five long vowel phonemes. The sixth short vowel /æ/ represents a new and emerging vowel in the speech of young adults. The vowel space is relatively compact, with minimum F1 values just under 500Hz in approximate terms and variability in the maximum F1 values in low vowels. These observations have previously been made for traditional Aboriginal languages of northern Australia [14] but not previously for Roper Kriol. This pattern suggests a possible role for the substrate (traditional) language in having influenced the implementation of vowels within what are historically English-derived words in the Roper Kriol lexicon. This situation seems to have a parallel in the mixed language Gurindji Kriol, spoken several hours further south-west, which has a compact vowel space in its English-derived as well as its Gurindji-derived lexicon [7].

Based on the patterns of (near) minimal pairs and the acoustic data from the spontaneous speech sample it appears likely that Barunga Kriol has a vowel length contrast. At each of three levels of vowel height the duration values for the tokens which were perceptually analysed by the researchers as short vowels tend to have values of under 100ms; long vowels are typically 100-200ms (Figures 7a-c). In many lexical items the vowel length contrast corresponds closely to the tense/lax distinction in Australian English. Not every lexical item, however, has been regularly assimilated, probably due to different timedepths of borrowing from English.

Several clear patterns of allophony emerge in these data which have not previously been described. These include the extensive allophony in the mid vowel /ε/ which shows tensing (like some world English dialects, but more extensive than Australian English e.g. [15]) and lowering (like some quite geographically distant Australian English varieties e.g. [16]).

The five diphthongs have modest movement in F1x F2. This is again similar to the patterns found for Gurindji Kriol [7] and rather unlike Australian English [16].

4. Conclusions

This paper describes the phonological and phonetic patterning of vowels in Barunga Kriol, a variety of north Australian Kriol. The paper constitutes the first acoustic description of the vowels in this language, and sets the scene for further work in corpus analysis and experimental work with adults and children, as well as technical development (e.g. forced alignment, ASR) for researchers and speakers of the language.

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