Bardi

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Bardi is the northernmost language of the Nyulnyulan family, a non-Pama-Nyungan family of the Western Kimberley region of northwestern Australia. Currently about five people speak the language fluently, but approximately 1,000 people identify as Bardi. The region was settled by Europeans in the 1880s and two missions were founded in Bardi country in the 1890s. Use of the language began declining in the 1930s. Many Bardi people were moved several times between 1940 and 1970, both to other missions dominated by speakers of other Indigenous languages and to local towns such as Derby. This community disruption accelerated the decline of language use in the community and first language acquisition. Bardi is the name of the language variety spoken at One Arm Point. There are two other named mutually intelligible varieties apart from Bardi: Baard and Jawi. The extent of dialect diversity within Bardi is unknown, but does not seem to have been particularly high compared to that between named varieties. The ISO-639 language code is [bcj].

This study is based on field materials collected by the first author since 1999, building on the recordings and field notes of previous researches on the language, especially Aklif (1994) and Metcalfe (1975). Recordings of narratives, wordlists, and elicitation total about 220 hours. While there is no formal standard language in the Bardi speech community, the speakers who provided illustrations are unanimously regarded as excellent speakers who are appropriately qualified to work with linguists in making a record of the language. They have been working on language documentation since 1990. Except where otherwise noted, illustrations come from two speakers.[1] One was 70 years old and the other about 82 years old at the time of recording of a wordlist of phonemic contrasts of 250 items in 2008; these wordlist recordings

[1] Sound files accompanying this article are available from the JIPA website. Recordings from the elicited wordlist have been supplemented by clips from field recordings. Because of the difficulty in reproducing studio-like conditions for recording, some of the clips from both wordlist and field recordings contain some background noise. There are no clips for verb roots, which are always inflected. A few clips are also taken from Gedda Aklif's digitized recordings, which were recorded with lower quality equipment.

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Table 1 Examples of heterorganic and homorganic nasal–stop and nasal–nasal sequences.

Cluster	Orthography	Phonemic	Meaning
ɳʈ	*warndang*	waɳʈaŋ	‘headband’
nɲ	*ngalar innyij*	ŋalar inɲij	‘he has his eyes open’
nk/nŋ	*ankorrbinngada*	ankorpinŋata	‘place’
ɲc/ŋc	*arinyjingjangarr*	aɻiɲciŋcaŋar	‘once in a while’
lŋg	*alnggoonooroo*	alŋkunuɻu	‘turban shell’

provide most of the illustrative examples for this article. There are no younger speakers of the language.

Syllable structure and word structure

Bardi has extensive inflectional morphology, particularly on verbs, which take prefixes, suffixes and additional clitics. Nouns, pronouns and adjectives are inflected for case and a subset of nouns take possession markers (by either prefix or suffix). Many prefixes are a single consonant; suffixes tend to be a single CVC or VC syllable.

Nouns, verbs, and coverbs can be reduplicated. Reduplication is to some extent lexically determined (that is, it is not fully productive). There are several patterns attested in the language. Monosyllabic words are fully reduplicated (sometimes with an epenthetic vowel); disyllabic nouns and coverbs are also fully reduplicated, while disyllabic verbs also exhibit partial reduplication. These are illustrated in (1). Q1

(1) a. *garr* /kar/ ‘rub’ reduplicates to /karkar/
b. *bawin* /pawin/ ‘cut’ reduplicates to /pawinpawin/ ‘butcher meat’
c. *-jala-* /cala/ ‘see’ reduplicates to /calala/

The syllable template for Bardi is presented in (2).

(2) (C) V (V) (l) (C)

No consonant clusters are permissible in the syllable onset. Open monosyllables are rare as independent words (though they do occur frequently as clitics); examples include *bo* /po/ ‘daughter’ and *joo* /cu/ ‘second person singular pronoun’. Words may begin with a vowel (e.g. *aamba* /aːmpa/ ‘man’) but all word-internal syllables contain onsets.

The possibilities for coda clusters are limited. Apart from the clusters which arise through the deletion of word-final vowels, the only permitted coda clusters are a lateral followed by a peripheral (that is, labial or velar) homorganic nasal–stop cluster, as in *almban* /almban/ ‘westerly wind’. Otherwise consonant clusters only appear across syllable boundaries, and possibilities here are also restricted. The most common clusters are lateral–stop (or trill–stop) and nasal–stop clusters. Liquid–glide clusters are also attested, for example in the words *gaalwa* /kaːlwa/ ‘mangrove double raft’ and *marrya* /marja/ ‘smoke signal’. There are tautomorphemic heterorganic nasal–nasal clusters (e.g. *biinmal* /biːnmal/ ‘weak’) and stop–stop clusters (*gaardga* /kaːʈka/ ‘bloodwood tree (*Eucalyptus polycarpa*)’). There are no geminates and where geminates would arise in morphology they are simplified to a singleton consonant. Examples are provided in Table 1.

The analysis of consonant clusters is complicated by a process of word-final vowel deletion; this is conditioned predominantly by word-external sandhi and speaker’s dialect. Vowel-final words frequently appear without a final vowel if the following word begins with a vowel (for example, *gorna inggidinirr* /koɳa/ /iŋkitinir/ ‘good still’ is realized as [kɔɳ ɪŋgɪdɪnɪr]). This rule applies even if a word-final cluster would otherwise result. For example, the temporal enclitic = *jamba* / = campa/ ‘when’ has two variants: [camba] and [camb].

When further clitics are added to the word, surface violations of the template given in (2) result; an example is given in (3g) below.

Bardi contrasts homorganic and heterorganic nasal–stop clusters, both within morphemes and across morpheme boundaries, e.g. *aanyjoo* /aːɲcu/ ‘yam’ vs. *aanja* /aːnca/ ‘return’. An example across a morpheme boundary is *i-n-joogool-ij* /i-n-cukul-ic/ ‘he broke it’ vs. *i-ny-joogool-ij* /i-ɲ-cukul-ic/ ‘it broke’.

Word-initially, there is no distinction between alveolar and retroflex consonants; all initial apical consonants are retroflex.[2] There are no words beginning with trills or the palatal lateral. Words beginning with /w/ and /j/ are rare due to a historical sound change where these were lost word-initially (the words that show these in Bardi are all loans from Nyulnyul (e.g. *wiirri* /wiːri/ ‘rib’), Worrorra (e.g. *walbiri* /walpiɻi/ ‘loincloth’) or English (e.g. *wajim irrmanyjin* /wacim irmaɲcin/ ‘they’re washing themselves’).

The majority of simple roots in Bardi are of two or three syllables, but due to the large amount of verb morphology it is not uncommon to find much longer words. Examples are given in (3). A key to abbreviations is given at the end of the article.

(3) a. *bo* /po/ ‘woman’s child’
b. *aamba* /aːmba/ ‘man’
c. *injalal*
/i-n-jalal/
3SG-TRANS-stare
‘he/she’s staring at something’
d. *goodarrowin* /kutarowin/ ‘brolga (*Grus rubicunda*)’
e. *bilanggamarr* /pilaŋkamar/ ‘helicopter tree’
f. *ingarramarramarragal*
/i-ŋ-ar-a-mara-mara-kal/
3-PST-PL-TRANS-REDUP-cook-REC.PST
‘they were cooking it’
g. *ingoorroongoorroongoorribinkaljambjarrngay*
/i-ŋ-urr-u-ŋuri-ŋuribi-n-kal = camb = carŋaj/
3-PST-PL-TRANS-REDUP-chase-CONT-REC.PAST = thus = 1SG.DO.FOC
‘so they kept chasing **me**’

Consonants

	Labial	Alveolar	Apico-postalveolar	Lamino-palatal	Velar
Stops	p *b*	t *d*	ʈ *rd*	c *j*	k *g*
Nasals	m	n	ɳ *rn*	ɲ *ny*	ŋ *ng*
Laterals		l	ɭ *rl*	ʎ *ly*	
Rhotics		r *rr*	ɻ *r*		
Glides				j *y*	w

Note: Orthography where different is given in italics.

[2] A referee questions this characterization and suggests that the realization of such consonants may vary according to the preceding segment. Butcher (1995) found evidence from five Australian languages that neutralized apical consonants were distinct from both intervocalic apical and retroflex consonants. We lack palatographic data for Bardi but acoustically, the initial neutralized apicals sound more like the retroflex series than the apical series, irrespective of whether a consonant or vowel precedes them in the previous word.

p	/lapan/	*laban*	‘body hair’
t	/watar ŋalma/	*wadarr ngalma*	‘I’m absentminded’
ʈ	/aʈan/	*ardan*	‘cloud’
c	/carpat inkacan/	*jarrbad inkajan*	‘to carry s.th. across’
k	/akal/	*agal*	‘and’
m	/namaʈ/	*namard*	‘only, just’
n	/anan/	*anan*	‘as soon as’
ɳ	/ŋaɳan/	*ngarnan*	‘stupid’
ɲ	/tiɲitiɲ/	*dinyidiny*	‘grasshopper’
ŋ	/alaŋ/	*alang*	‘south’
l	/aːla/	*aala*	‘man’s child’
ɭ	/aːɭi/	*aarli*	‘fish, meat’
ʎ	/kuːʎi/	*goolyi*	‘bowerbird’
r	/ara/	*arra*	‘no’
ɻ	/aɻa/	*ara*	‘other’
j	/muja/	*mooya*	‘morning’
w	/uːwa baːwa/	*oowa baawa*	‘little kid’

Bardi has 17 consonant phonemes, 12 which are sonorants. There are no fricatives; the five obstruents are stops. Bardi has five place of articulation contrasts: alveolar, retroflex, palatal, bilabial, and velar; the latter two are referred to in the literature as ‘peripherals’ (see e.g. Dixon 2002). As there is no voicing contrast in stops, we represent the stops as voiceless.[3] We discuss stop voicing alternations in the ‘Lenition’ section below.

The phonemic system follows a typical pattern found among Australian languages, where stops have a corresponding nasal contrast at each place of articulation, as illustrated in the Consonant Table above.

Laterals contrast at the three coronal (including palatal) places of articulation; there are no peripheral lateral contrasts. Thus, there are five liquid contrasts, an apical and retroflex series of laterals and rhotics, and a palatal lateral. The words listed above illustrate the Bardi consonantal phonemes in intervocalic position.

More than half the phonemes are represented by digraphs in the orthography. Velar and palatal nasals and the palatal lateral are represented by the digraphs *ng* /ŋ/, *ny* /ɲ/ and *ly* /ʎ/, respectively. The nasal–stop digraphs (cf. *anggaba* /aŋkapa/ ‘who’) are distinct from the heterosyllabic nasal–stop sequences such as *nk* in *inkan* /inkan/ ‘tiger snake (*Notechis scutatus*)’ and the velar nasal, as in *angan* /aŋan/ ‘closeby’. A discussion of consonant clusters appears in section ‘Syllable structure and word structure’ above .

Retroflex sounds are represented by the digraphs *rd* /ʈ/, *rn* /ɳ/, *rl* /ɭ/, but the graph *r* for the retroflex rhotic /ɻ/. The apical lateral and rhotic are written as *rr* and *l*. Thus, the five liquid consonants are written as *rr* /r/, *r* /ɻ/, *l* /l/, *rl* /ɭ/ and *ly* /ʎ/. The orthography of Bardi uses voiced symbols to represent the stops *b* /p/, *d* /t/, *rd* /ʈ/, and *g* /k/, though, as noted, no phonemic voicing contrast exists in the language.

[3] In the UCLA’s UPSID database (Maddieson 1984), 15.3% of the languages in the database have a single series of stops, and these are voiceless. The only language with a voiced stop in the single stop series (Bandjalang; see Crowley 1978) is Australian. (Hamilton 1996 lists a few more examples, including Wambaya and Yuwaaliyaay.) Maddieson (1984) uses Bardi as a representative of the Nyulnyulan family (using data from Metcalfe 1971), and uses the voiceless symbol. Keating, Linker & Huffman (1983) observe that in initial position, this pattern of voicelessness is related to aerodynamic and articulatory factors that make obstruent voicing more effortful than voicing in sonorants. Our choice of the voiceless symbol is based on these facts.

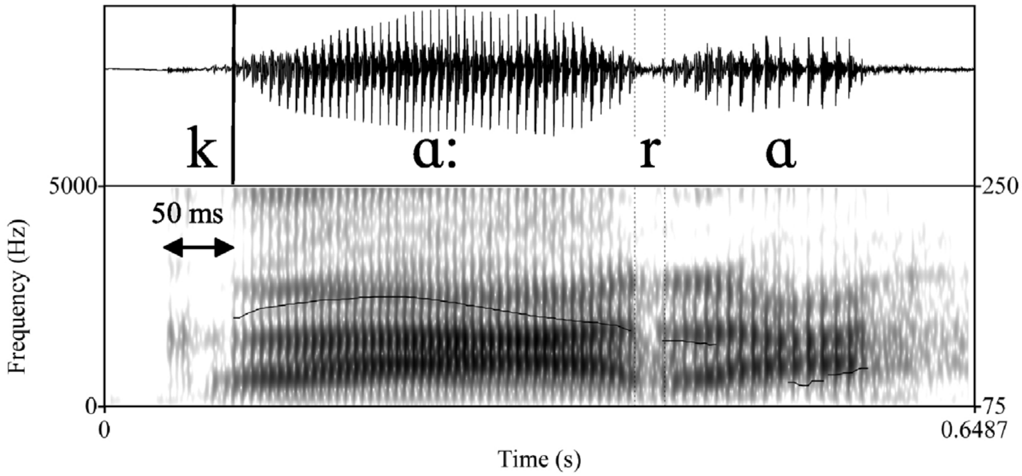

Figure 1 A spectrogram and waveform of *gaarra* /kɑːrɑ/ [kɑːɾɑ] 'uncle', illustrating the initial voiceless stop /k/, with a 50 ms VOT.

Plosives

Stop contrasts occur at five places of articulation, as indicated in the Consonant Table above. Voicing is not contrastive in stops, though voiced and voiceless stops occur in the language as allophonic variants through lenition and voicing (see 'Lenition' section below). Stops can occur in initial position, intervocalically, in heterosyllabic nasal–stop and stop–stop clusters (see section 'Syllable structure and word structure' above), and in word final position. A process of word final devoicing affects all segments regardless of type; this is particularly found at phrasal boundaries and so is frequent in the elicited wordlist. Stops thus remain voiceless word-finally. Intervocalically, stops exhibit considerable variation and are often lenited. Examples appear below.

Figure 1 is a token of *gaarra* /kɑːrɑ/ [kɑːɾɑ] 'uncle (mother's brother)' spoken by a female speaker reciting a wordlist. In this token, the initial /k/ is voiceless and has a VOT of about 50 ms, classifying this as an aspirated reflex of the /k/ phoneme, an unaspirated voiceless stop. However, this sound lacks the plosive (puff of air) quality common to aspirated stops; it sounds like an unaspirated /k/, as we transcribe it. This pattern is common throughout our data. Another example is found with the token of *inkan* /inkɑn/ (Figure 3b), where a release burst appears to be present halfway through the intervocalic stop. As in the present example, there is no puff-of-air quality to this stop; it sounds like an unaspirated voiceless stop. We attribute this to a general lack of vocal tractk constriction (versus occlusion) that we find to be a characteristic of Bardi speech. There is little evidence in our data for any airflow turbulence, which is needed in the production of frication. We suggest that this pattern also appears in the tendency of stops to lenite to more approximant-type articulations, without producing the constriction needed to produce turbulence. We suggest that this may be causally linked to the lack of fricatives in the phonemic inventory, as a kind of featural structure constraint, though the nature of this dependency is open to investigation.

Lenition

There are two lenition processes in Bardi, synchronic and historical. The synchronic process lenites the phonemically voiceless stops to a more sonorous reflex. In this process, the voicing of the preceding segment is continued through the stop. It is an audible property of Bardi speech which can give the stops a near approximant-like quality. Lenition in Bardi, as a synchronic process, is to some extent speaker-dependent and subject to stylistic factors which it is beyond the scope of this paper to discuss. Figures 2, 3b and 4 provide illustrations. In

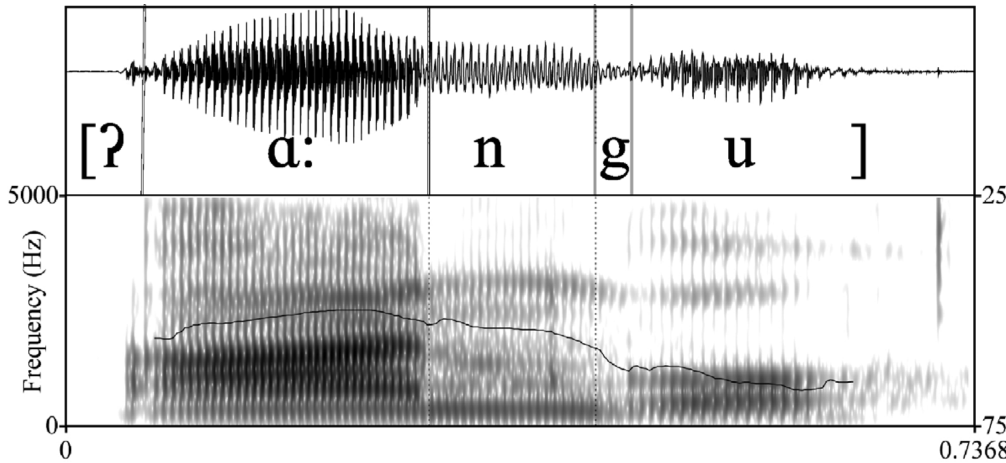

Figure 2 A spectrogram and waveform of a hetero-organic nasal–stop cluster /nk/ in *aankoo* /ɑːnku/ [ʔɑːngu] 'for a while'. A phonetic transcription is provided.

Figures 2 and 4 the stop is lenited to a voiced reflex in a nasal–stop cluster, *aankoo* /ɑːnku/ [ʔɑːngu] 'for a while', and between two vowels, *ardan* /ɑʈɑn/ [ʔɑɖɑn] 'cloud'. In Figure 4 is an illustration of an unlenited voiceless stop in a nasal-stop cluster: *inkan* /inkɑn/ [ʔinkɑn] 'tigersnake'.

The historical lenition is a sound change whereby historical stops become glides (or are lost) in Bardi. This results in morphological alternations in, for example, the allomorphy of verb roots. For example, the root *-gama-* /kama/ 'laugh, mock' has present (intransitive) /i-**jama**/ but present (transitive) /i-n-**kama**/, and plural transitive /i-ŋ-arr-**ama**/. See further Bowern (2012) for details of this set of changes and the morphological alternations it has conditioned.

Voicing

As mentioned above, stops are phonetically voiceless in initial and final positions and variable elsewhere. This example, *ilaj* /ilɑc/ [ʔilɑj] 'clamshell', exemplifies a stop in final position in a word (see Figure 3a). In this example, the stop is a lenited reflex of the palatal stop /c/. The frequency range of this spectrogram is 0–10k Hz. The 10 ms window shows the waveform at the end of the vowel and into the stop. Note the lack of any clear stop closure, as the vowel formants continue into the final segment. There is slightly more energy in the higher frequencies of this sound at around 5 kHz, in comparison to the intervocalic approximant /l/, where the energy is below 4 kHz. This pattern may indicate some oral constriction, though it is a very approximant-like sound. (An illustration of an initial voiceless stop was given in (1) above.)

Stops tend to be voiced in nasal–stop clusters, but there are exceptions. Illustrations are given below. Figures 3b and 3c are examples of voiced and voiceless stops in nasal stop clusters. The velar stop /k/ is voiceless, the stop closure period is indicated in a 10ms window below the spectrogram. Note also the presence of a release-like articulation midway through the sound. However, the audible percept is a clear unaspirated velar stop.

Figure 3d is a spectrogram and waveform of the sequence /kɑːʈka/ [kɑːɖka] from the phrase *gaardga jina* /kɑːʈka cinɑ/ 'the bloodwood's (*Eu- calyptus polycarpa*)', exemplifying the articulation and voicing of a heterorganic and heterosyllabic stop–stop cluster. The transcription is phonemic. The first stop in the cluster, the retroflex /ʈ/, appears as the voiced reflex [ɖ]. This sound is followed by an unaspirated voiceless velar stop [k]. Both stops exhibit clear indications of oral closure and release, making segmentation straightforward. Note the initial /k/ has a VOT of about 30 ms. Figure 3e is a 10 ms window around the respective stops contrasting the voicing variations.[4]

Although the great majority of stops are unaspirated, with near zero VOTs, the voiceless realizations of stop consonants are sometimes weakly aspirated. This is very variable, but found particularly with /k/ and /c/ reflecting a near universal tendency for stops posterior to the coronal region to have longer VOTs (Ladefoged & Maddieson 1996). Figure 3b provides an illustration.

Retroflection

Retroflex consonants in the language are *rd* /ʈ/, *rl* /ɭ/, *r* /ɻ/ and *rn* /ɳ/. The cues for retroflection include a lowering of F3 in a preceding vowel and often resulting in an audibly rhoticized vowel preceding the retroflex consonant. Examples are found in Figures 4 and 3d. Figure 4 is a spectrogram and waveform of ardan /ɑʈɑn/ [ʔɑɖɑn] ‘cloud’. This is an example of an intervocalic retroflex stop /ʈ/, this token is voiced throughout its duration.

The retroflex consonants are apical. They appear to maintain a stable position during the stop articulation, visible in the formant structure of F3 as it drops to meet F2 into and out of the stop segment. The retroflex consonants are apical. They appear to maintain a stable position during the stop articulation, visible in the formant structure in which the F3 target into and out of the stop segment is approximately the same.

There are constraints on clusters with alveolar and retroflex segments. There are no recorded clusters with both retroflex and alveolar members; clusters of the type *ɳd* or *nɖ* are not found in this language (orthographic *rnd* is [ɳɖ]). There is a small amount of evidence for apical dissimilation across syllables in both laterals and nasals (apical stops are sufficiently rare that the relevant environment for alternations does not arise); F3 appears to dip with repeated alveolar laterals, and in a sequence of heterosyllabic lateral followed by nasal or lateral followed by lateral, the second lateral often has a lowered F3. In tokens of the word *ngalal* /ŋalal/ ‘dry coral’, for example, the lateral in C3 has an F3 of approximately 300 Hz lower than the lateral in C2 position, even though it is phonemically apico-alveolar, not retroflex. (See Tabain 2009 for discussion of variable retroflex pronunciation in the Pama-Nyungan language Arrernte.)

Sonorants

The sonorants are phonologically and phonetically stable segments. Since they comprise a large part of the phoneme inventory, and the stops tend to lenite, the speech stream is primarily comprised of sonorant sounds uninterrupted by obstruent constriction.

Nasals occur at places of articulation that correspond to the stops, resulting in contrasts at five places of articulation. Nasals may appear in syllable-initial and syllable-final position. In medial position, heterorganic nasal–nasal clusters are not uncommon (see Figure 5) and appear in both derived and underived words. Examples include *binymarr* /piɲmar/ ‘louse egg’, *anyngarr* /aɲŋar/ ‘in vain, without anything happening in return’, and *nanmoorroo* /nanmuru/ ‘thigh’. In underived contexts, the first member of the pair must be non-peripheral (/n/, /ɲ/ or /ɳ/), and the second must be peripheral (/m/ or /ŋ/). In derived environments there are no limits on such clusters.

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[4] Note in the orthography for these words that *inkan* is written with a voiceless stop. Orthographic *k* is used after /n/ to represent the heterorganic cluster /ng/ and to avoid ambiguity with the velar nasal /ŋ/, which is represented in the orthography as *ng*. English orthographic conventions are not likely to be conditioning the voiceless realization of the stop in Figure 3b, however, since literacy in Bardi is very recent and not much used.

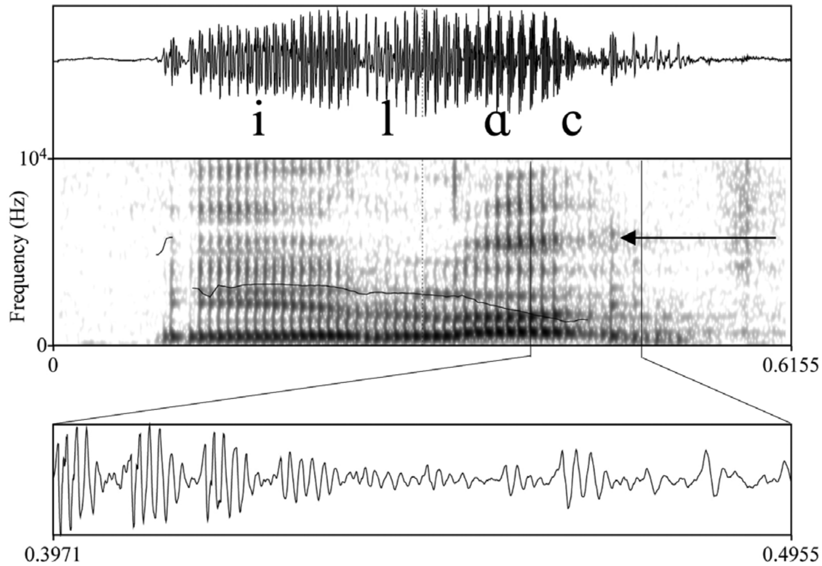

Figure 3a A spectrogram and waveform of a lenited reflex of the palatal stop /c/ in final position in a word: *ilaj* [ilɑc] [ʔilɑʲc] 'clamshell'.

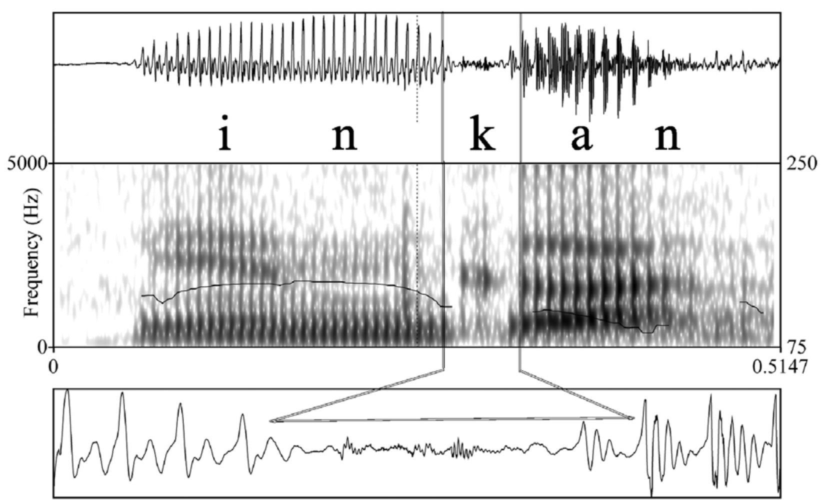

Figure 3b A spectrogram and waveform of the word *inkan* /inkɑn/ [ʔinkɑn] 'tigersnake *Notechis scutatus*' demonstrating the heterorganic nasal–stop sequence /nk/. The stop is voiceless.

Vowels

The table below gives the Bardi vowel phonemes, along with their orthographic representation (in italics). Vowel length is phonemic and minimal and near-minimal pairs are presented below the table. The mid back vowel /o/ is the single mid vowel in the system; it is historically a contraction and coalescence of /aku/ and /awu/. This vowel is often phonetically long, as befits its historical origin, but does not contrast in length.

i iː: *i*, *ii*	u, uː: *oo*
	o *oo*
a aː: *a*, *aa*	

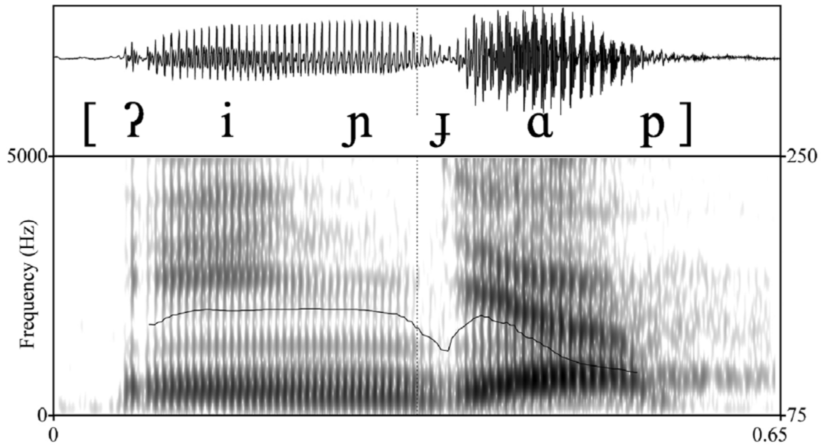

Figure 3c A spectrogram and waveform of *inyjab* /iɲcɑp/ [ʔiɲɟɑp] 'cousin', an example of a homorganic nasal–stop sequence. The palatal stop is voiced.

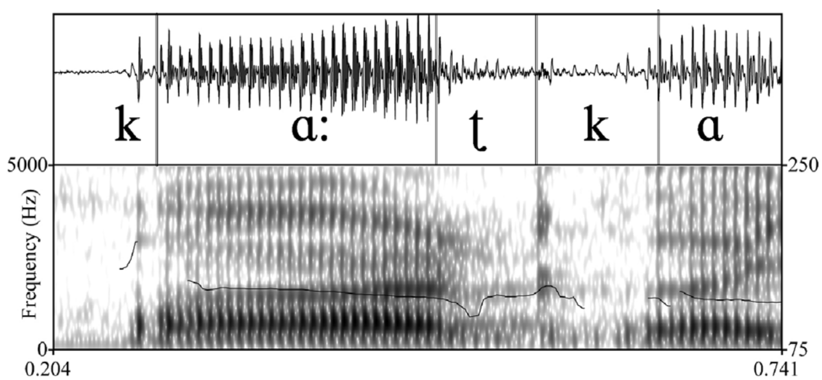

Figure 3d A heterosyllabic and heterorganic stop–stop cluster /rdg/ in *gaardga* /kaːʈka/ [kɑːʈka] 'bloodwood (*Eucalyptus polycarpa*)'.

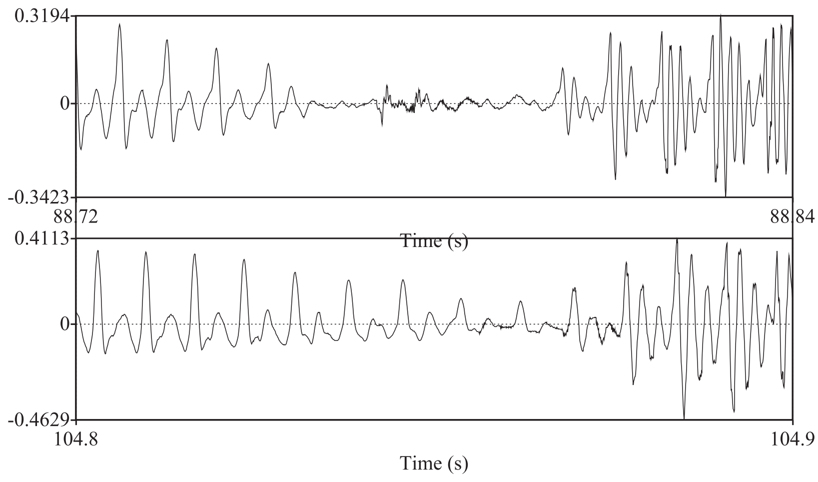

Figure 3e A 10 ms window of waveforms illustrating the voicing variation found in stops in nasal–stop clusters. Clusters: /nk/ (top) and /ɲj/ (bottom).

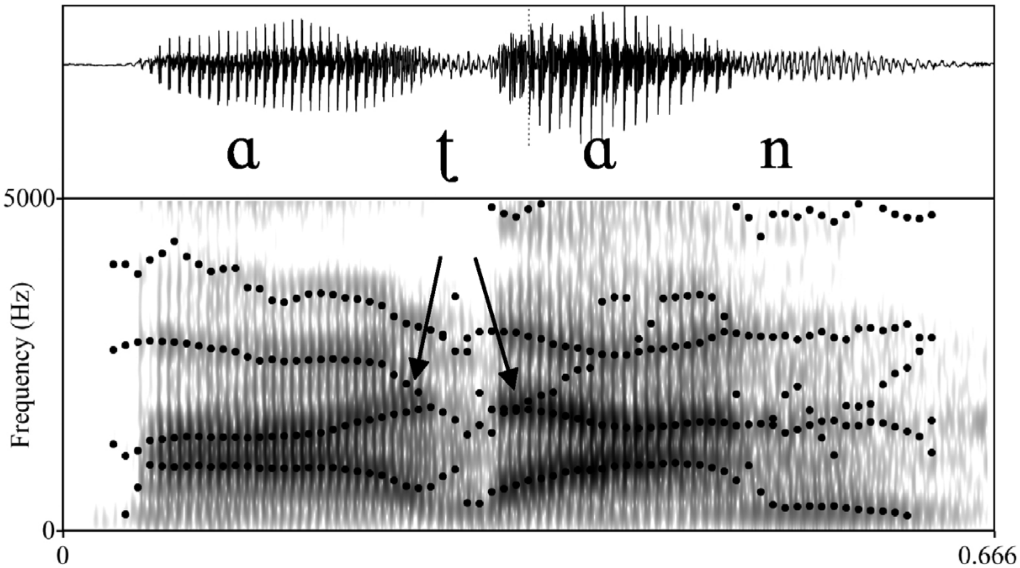

Figure 4 A spectrogram and waveform of *ardan* /ɑʈɑn/ [ʔɑɖɑn] 'cloud', an example of an intervocalic voiced retroflex stop /ʈ/.

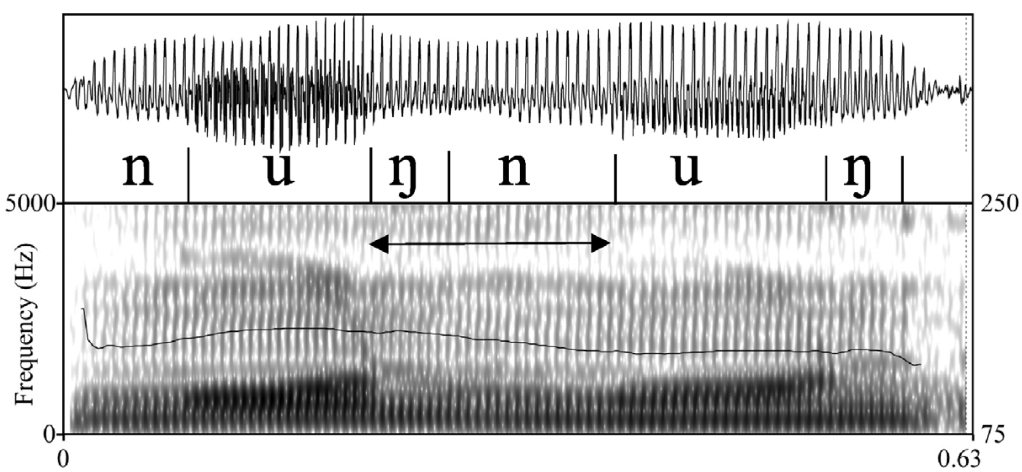

Figure 5 A spectrogram and waveform of *ngoonngoon* /ŋunŋun/ [ŋunŋun] 'bark (of dog)', illustrating a heterorganic nasal–nasal cluster. The arrows indicate the nasal cluster.

a	/alaŋ/	*alang*	'south'
aː	/aːlaɳ/	*aalarn*	'lung'
i	/ilac/	*ilaj*	'clam shell'
iː	/iːla/	*iila*	'dog'
o	/olorki/	*olorrgi*	'seagull'
u	/nuŋu/	*noongoo*	'stomach'
uː	/uːla/	*oola*	'water'

The most common vowel in the data set is overwhelmingly the low vowel /a/. In the wordlist of 250 items, there were 624 tokens of /a/; the next most frequent vowel was /i/, with 397 tokens (both in all positions in the word). The other short vowel /u/ had 274 tokens. Long vowels were much rarer, with 83 tokens of /aː/, 40 of /iː/ and 34 of /uː/. There were 64 tokens of /o/. These relative frequencies are reproducible from the Bardi dictionary; see further Bowern (2012: 90–97) for discussion of segment distributions. Part of the large disparity in token numbers results from long vowels being disproportionately rare outside initial stressed syllables. Diphthongs may occur as variants of vowels. An example is *milgin* /milkin/ [milgɪ͡ən] ‘walking stick’.

A vowel chart is presented in Figure 6a. The chart illustrates the F1 and F2 vowel means and 1 standard deviation (StD) from the mean. The measurements were taken from the midpoint of each vowel using Praat (Boersma & Weenink 2010) and plotted using NORM (Thomas & Kendall 2007). The short vowels are slightly more centralized than the long vowels, but the quality of long and short vowels does not differ markedly; this can be seen in Figure 6a and also in Figure 6b, which compares vowels in stressed (1) and unstressed (2) syllables.

Prosodic features

Two important aspects of Bardi prosody are a stress system consisting of independent primary and secondary stress assignments, and an intonational system. The intonation system consists of boundary tones and pitch accents that interact with the stress system. We discuss each separately below.

Stress

Bardi is analyzed as having a stress system. By stress we mean relative syllable prominence. Bardi stress is not a lexical pitch accent system. Primary stress is regular and appears consistently on the initial syllable of the word. Stressed vowels are characterized by increased duration compared to unstressed vowels (see Katsika 2008), though there is also a phonemic distinction in length in both stressed and unstressed syllables. In stressed syllables there are also increases in intensity and, in some cases, pitch, likely related to the intonational system. Unstressed vowels are somewhat more centralized than stressed vowels (see Figure 6b).

While primary stress is predictable and regular, the rules for secondary stress are complex and are sensitive to morphological structure and syllable weight. A light syllable is an open syllable with a short vowel; syllables with codas and long vowels are heavy. With respect to morphology, there is a split between nouns and verbs: verbs carry stress on the first syllable of the root, while prefixed nouns do not receive a comparable root stress. Some morphemes with closed syllables receive a secondary stress: for instance, case markers such as the ergative *-nim* and allative *-ngan*, monosyllabic clitics such as the third person singular possessive marker = *jin*, and the sentence connective = *min*; these are all heavy syllables. Agreement clitics also carry stress. Speakers differ as to whether they produce consecutive stressed syllables where clitics follow case markers; some stress both, as in (4a), while others stress only the last, as in (4b), or the first, as in (4c).

(4) a. *gooloo-nim =jin*
ˈkuːlu-ˌnim =ˌcin
father-ERG =3SG.POSS
‘his/her father [did something]’
b. ˈkuːlu-nim =ˌcin
father-ERG =3SG.POSS
‘his/her father [did something]’
c. ˈkuːlu-ˌnim =cin
father-ERG =3SG.POSS
‘his/her father [did something]’

For morphologically simple words, the generalizations are as follows. In disyllabic and underlyingly trisyllabic words, there is a single primary stress on the initial

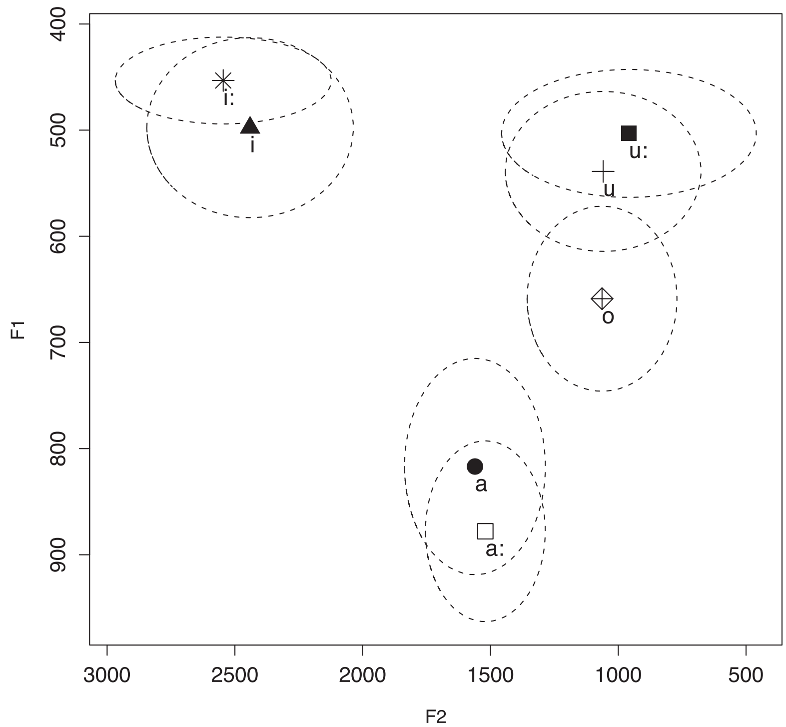

Figure 6a Mean values and 1 StD for vowel phonemes.

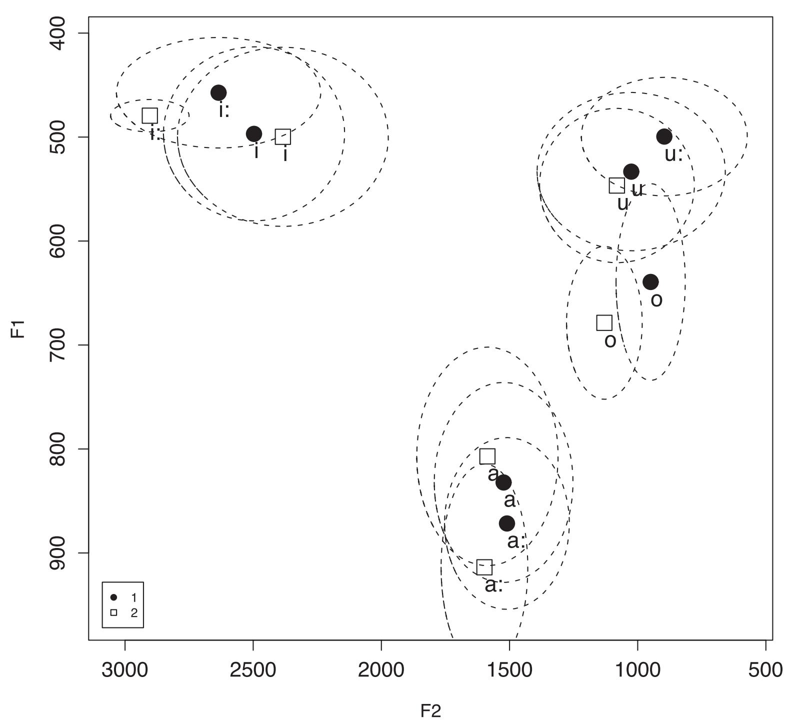

Figure 6b Bardi stressed (1) vs. unstressed (2) syllables.

syllable.[5] In trisyllabic words derived from tetrasyllabic words with a deleted final vowel, there is secondary stress on the third syllable (which is always heavy). In tetrasyllabic words, the secondary stress is on the third syllable if the fourth is light, and the fourth if it is heavy. These patterns are illustrated in (5) below. Subsequent secondary stresses are assigned in the same way; on final heavy syllables, or otherwise to the penult, then left to right alternating stress, though examples with underived words are rare. The alternation pattern may be broken by morphologically assigned stress (i.e. verb roots and some affixes and clitics with heavy syllables), sometimes resulting in stress clash, as noted above.

(5)	a.	*gooloo*	'father'	/ˈkuːlu/
	b.	*nimoonggoon*	'his knowledge'	/ˈnimuŋkun/
	c.	*milimili, milimil*	'paper'	/ˈmiliˌmili/ [ˈmiliˌmili] ~ [ˈmiliˌmil]
	d.	*Galaloongoo*	(name of culture hero)	/ˈkalaˌluŋu/ ~ [ˈkalaˌluŋ]
	e.	*bilanggamarr*	'helicopter tree'	/ˈpilaŋkaˌmar/
	f.	*Bilingbilinggoon*	place name	/ˈpiliŋˌpiliŋˌkun/
	g.	*jawoorrgawoorrga*	'whirlpool' (song language word)	/ˈcawurkaˌwurka/

Intonation

As no previous studies of Bardi intonation have been conducted, we offer a sketch of the intonational system based on observations made across three speakers from a corpus of casual speech and storytelling. It has been claimed (Fletcher, Evans & Ross 2002) that Australian languages tend not to show a variety of tune types or contours associated with pragmatic and/or discourse functions, though exceptions such as Kayardild have been noted. The Bardi system may be considered primarily a demarcative system, though we stress that work is preliminary and a detailed study of the interaction between intonation, clause types, and pragmatic structure has not yet been undertaken. Our remarks are based on observations of the contours found in the corpus, intended to give a broad overview of the intonational system for purposes of comparison to patterns found in other related and unrelated Australian languages, and as a foundation for further analyses.

The basic contour consists of at least one peak (H*) followed by a fall to the end of the utterance. This peak is generally aligned to the primary stressed syllable of the first content word in the utterance; the alignment tends to be early in the syllable. The contour also commonly allows pitch accents on other primary stressed syllables in the utterance, in which case these are marked by downstepped H* (!H*), resulting in a tiered contour, characteristic of the data. Figure 7 demonstrates this pattern. The first pitch accent (H*) typically occurs on the first syllable of the first content word in the utterance, in this example, not on the initial word, a negation marker. A downstepped tone (!H*) appears early in the last word of the utterance followed by a fall to the boundary tone (L%). We mark an initial reset boundary tone (R%) here to demonstrate that the utterances begin near the top of the speaker's pitch range.

In some cases secondarily stressed syllables within a word may also carry a pitch accent, also realized as a small rise to a peak early in the syllable; these tend not to be downstepped. In some utterances, the highest peak occurs later in the utterance, associated with a focus on that word; this peak is an expanded peak, which we label L+H* to indicate an upstepped H*.

[5] Underlyingly trisyllabic words have three syllables in citation form but which may be additionally subject to final vowel deletion, resulting in disyllabic surface forms.

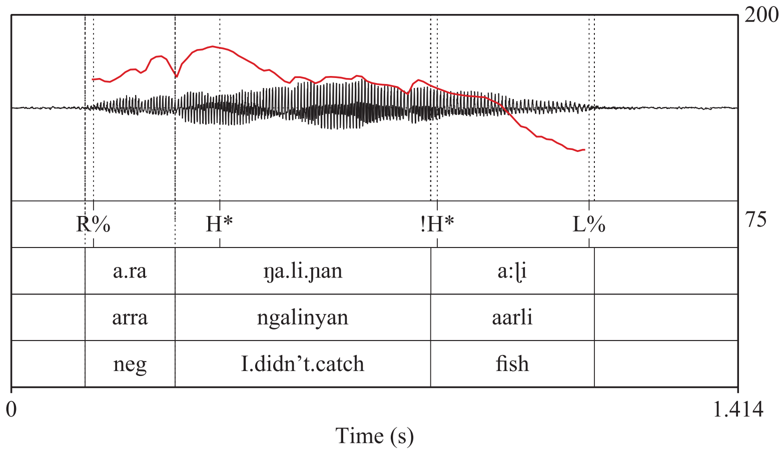

Figure 7 (Colour online) A typical statement contour in the data set. The first pitch accent (H*) typically occurs on the first syllable of first content word in the utterance. The initial reset (R%) demonstrates that the utterance begins near the top of the speaker's pitch range.

Examples are found in Figures 8 and 9. With this exception, H* is the single pitch accent in the data.

We have found evidence for two phrases: an utterance-level or intonational phrase (IP) and an intermediate or accentual phrase (AP) boundaries. As in Fletcher et al.'s (2004) study of Dalabon (Gunwinyguan) intonation and phrasing, the Bardi accentual phrase is followed by a pitch reset. Given that the system is primarily demarcative, we suggest that a reset boundary tone (R%) marks the left edge of AP and IP phrases. The R% indicates a reset at the upper edge of the speaker's pitch range. Right edge IP events are marked by H% and L% tonal events. The L% occurs after the last pitch accent in the phrase and is marked by a fall to the end of the utterance. The H% is local to the edge of the utterance and is marked by a rapid rise (Figures 8a and 8b).

We annotate the focus phrase ('a BOY-child') in Figure 8a with a medial boundary tone LH- which rises from a low tone. As noted, this is a somewhat stylized utterance and is uncommon in the data. Otherwise, we propose two intermediate tones H-, and M-, with the caveat that we are using the M- to indicate a flat contour that is followed by a pitch reset. The H- is a list intonation/continuation marked by its extended range, above the initial reset. Although the existence of an intermediate phrasal boundary in auto-segmental metrical theory (Ladd 2008) may indicate a bitonal IP phrase, we forgo this for the sake of simplicity. There is no evidence in the data of any factorial combinations of boundary tones as indicated by a bitonal analysis. As noted, the inventory of intonational tones, pitch accents and contours is restricted.

We suggest that one potential difference between primary (initial) and secondary word stress is the alignment of an intonational event, an H* pitch accent, to initial syllables of content words. An initial syllable with an H* pitch accent will carry an additional cue to prominence in the pitch excursion that a secondarily stressed syllable without the pitch accent lacks. This proposal needs further investigation.

Transcription of connected speech

The following story is an extract of a longer text of a telling of a 'frog story' (see Bavin 2004, Wilkins 2004). The wordless picture-book series illustrated by Mercer Meyer is commonly

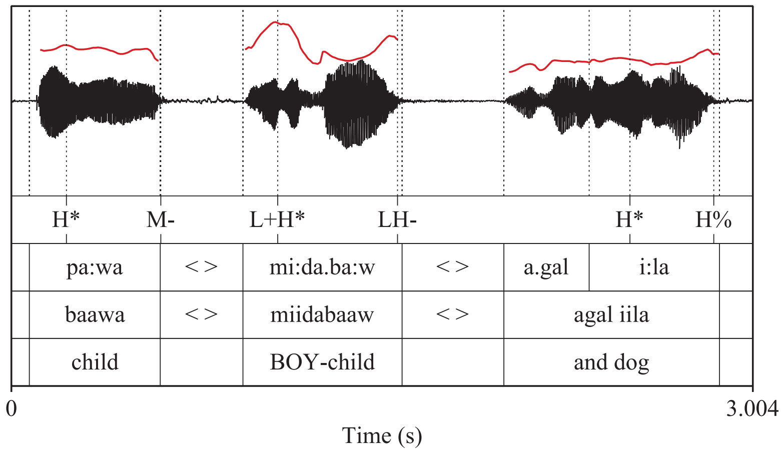

Figure 8a (Colour online) The opening phrases of the story in this text, including a stylized intermediate phrase 'Boy-child'; L+H* represents an upstepped H. LH- is a rising medial boundary tone. The utterance-final H% is a continuation boundary tone.

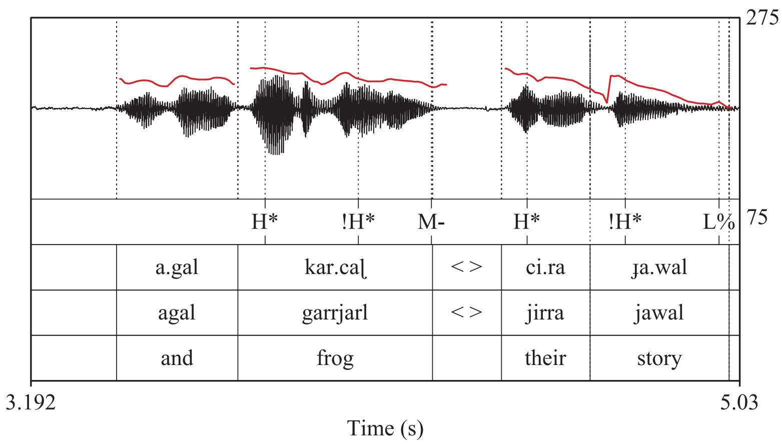

Figure 8b (Colour online) Continuation of the utterance in Figure 8a, with M- phrase tone followed by a pitch reset, an H* pitch accent, a downstepped pitch accent and final low boundary tone.

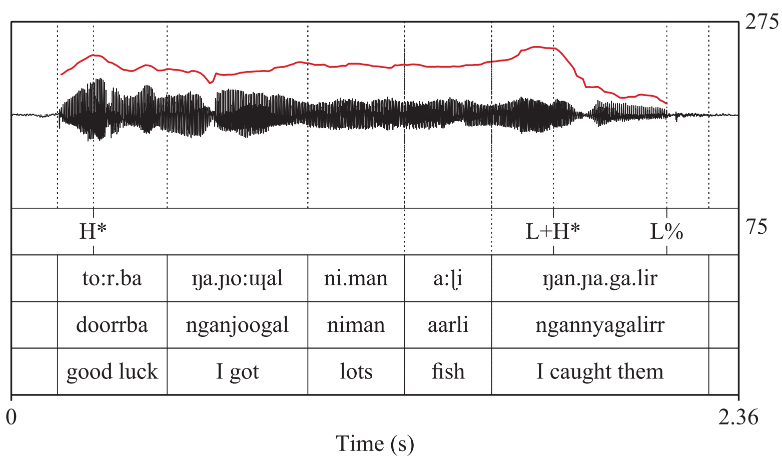

Figure 9 (Colour online) A substained contour with initial H* pitch accent and with L+H* (upstepped H) prominence marking on a verb, followed by a low boundary tone.

used in language documentation (Bowern 2008: 116).[6] The transcription is broad phonetic, with practical orthography and interlinear gloss.

(i)

bɑːwɑ ‖	midəbɑʊ ‖	ɑɣɑl	iːlɑ	ɑgɑl	gɑrjɑɭ	cirə	cɑwɑl ‖
baawa	*miidabaawa*	*agal*	*iila*	*agal*	*garrjarl*	*jirra*	*jawal*
child	male.child	and	dog	and	frog	3PL.POSS	story

This is a story about a boy, a dog, and a frog.

(ii)

midɑbɑːw	jɪnɑ	cɑwɑl	ɑgɑl |	iːlɑ ‖	ɑgɑl	gɑrcɑɭ ‖
miidabaawa	*jina*	*jawal*	*agal*	*iila*	*agal*	*garrjarl*
boy	3SG.POSS	story	and	dog	and	frog

ŋɑnmɑn	cibɑ ‖
nganman	*jiba*
1SG.PRES-put-CONT	this

I'm telling a story about a boy, a dog, and a frog.

(iii)

ulɒn |	cubolɟubol	ɪrɪn ‖
oolon	*jooboljoobool*	*irrin*
water-LOC	swim	they-do

They swim in the water.

(iv)

ɹoəlɪ |	ɪnɲɑ ‖	miːdəbɑwə	agal	iːlə |	bɑɖə |	bɑlɪŋan ‖
roowil	*innya*	*miidabaawa*	*agal*	*iila*	*barda*	*baarlingan.*
walk	he-does	boy	and	dog	away	home

The boy walks with the dog to his house.

(v)

ɪnəmɪjɪn |	miːdəbɑwnɪm	ɪnɑmɪjɪn	bɑːgɪdi |
inamijjin	*miidabaawanim*	*inamijjin*	*bagidi*
he-searched-for-his	boy-ERG	he-searched-for-his	bucket

nɛːd	ɪnəmɪjɪn |	gɑɳɖɪ |	bɑɖə |	ruəl	inɲə	cubol	inɟʊ
niid	*inamijin*	*garndi*	*bardi*	*roowil*	*innya*	*joobool*	*injoo*
net	he-searched-for	above	off	walk	he-did	swim	he-did

‖ bɪləboŋgon ‖
bilabonggoon
billabong-LOC

The boy's looking for his bucket and net, then he goes off and swims in the billabong (lake).

[6] We did not use the 'North Wind and the Sun' story because the story is unfamiliar to our consultants. Instead, we used another prompt which is common in cross-linguistic research.

(vi) giɲiŋgɔn | ɪmbɑɲiɟɪn || ɪmbɑɲi | cubolb ɪnco ||
347 *ginyinggon imbanyijin imbanyi jooboolb injoo*
then he-finished he-finished swim-REL he-did
balab ɹuil ɪnɲa baɖ ar ɪndan ||
balab roowil innya bard arr indan
this.way walk he-did off come he-did

Then he's done (he finds it), and he goes for a swim, and he goes for a
348 walk.

(vii) bʊlŋʊr ɲʊn ɪnɟal bɪləboŋ | garcaɭ ɪnɪn gaɳɖɪ |
boolngoorr nyoon injal billabong garrjarl inin garndi
halfway || here he-saw billabong frog he-sits on-top
bɪlɪlon
bililon
on-leaf

349 In the middle of the billabong he sees a frog on a lily pad.

(viii) iɲɟarələ ɲæləb | laɖaŋɑn injaliç | garɟaɭ | iːl agal
350 *inyjarrala nyalab lardangan injalij garrjarl iila agal*
3SG-PST-run this-way to-underneath he-saw frog dog and
midəbaw ɪŋarcarələ baɖə ||
miidabaawa ingarrcarrala barda
boy 3PL-ran away

351 He ran and saw the frog go underneath; the dog and the boy ran away.

(ix) wir ɪŋarjarmɪn jubol ɪŋɪɾɪn ɲuno pɪləboŋgon ||
wirr ingarrjarrmin joobool ingirrin nyoono bilabonggon
got-up they-did swim they-did from-here in-the-billabong

352 They jumped into the water.

(x) puɲɟe ɪral karəgʊn iːla | miːdəpawə agal karcaɭ ||
boonyja irral gaarragoon iila miidabaawa agal garrjarl
all they-were in-the-water dog boy and frog

353 They were all in the water – the dog, boy and frog.

(xi) olal ɪŋargaɖi | bɑːw agal | iːla | buɣun garɟəɭnɪm arə
oolal ingarrgardi baawa agal iila boogoon garrjarlnim arra
water they-entered boy and dog inside frog-ERG not
oːlalənəɾ ||
oolalanirr
he-see-them

They entered the water – child and dog, and the frog couldn't see them.

(xii)	daral	ɪŋorbul	|	bəlab	|	aŋanaɖ	|	garɟaɭnim
	darral	*ingoorrbool*		*balab*		*anganard*		*garrjarlnim*
	come-out	they-came		this-way		really-close		frog-ERG

ɪnɟalɪɾ	aŋanaŋar	|	dɔrɔlb	ɪŋorobol	||
injalirr	*anganangarr*		*dorrolb*	*ingoorroobool*	
saw-them	really-close		emerging	they-came	

They came up really close to the frog and he saw them as they came up.

(xiii)	ɲaləbʊ	|	gaɳɖ	ɪnɪn	bɪlɪlɔn	garɟaɭ	||
	nyalaboo		*garnd*	*inin*	*bililon*	*garrjarl*	
	this-way		on-top	he-is	on-leaf	frog	

He's on top of the lilypad.

(xiv)	gɪɲɪŋɣɔn	wɪr	ɪɲɟarmɪn	bilɪlɔ	baɖɪ	ɲʊn	ɪnɪn
	ginyinggon	*wirr*	*inyjarrnim*	*bililo*	*bardi*	*nyoon*	*inin*
	then	get-up	he-did	from-leaf	off	here	he-sits

bɔɖɔɣɔn	|	gaɳɖɪ	garɟaɭ	inɟaɹgɪɟɪr	||
bordogon		*garndi*	*garrjarl*	*injargijirr*	
on-tree-branch		above	frog	he-feared-them	

Then he got off his lilypad and sat on the tree trunk above; he was afraid of them. ...

Abbreviations

Abbreviations used in example glosses are as follows: CONT = continuous aspect; DO = direct object; ERG = ergative; FOC = focus; LOC = locative; PL = plural; POSS = possessive; PST = (remote) past; REC.PST = recent past; REDUP = reduplication; SG = singular; TRANS = transitive.

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