The Phonological/Grammatical Mismatch in the Dalabon Word: A Phonetic Study

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2003
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acknowledgements</td>
<td>iv</td>
</tr>
<tr>
<td>Abstract</td>
<td>v</td>
</tr>
<tr>
<td>Phoneme inventory and orthographic conventions</td>
<td>vi</td>
</tr>
<tr>
<td>Abbreviations</td>
<td>vii</td>
</tr>
<tr>
<td>1 Preliminaries</td>
<td>1</td>
</tr>
<tr>
<td>1.1 Aims of this study</td>
<td>1</td>
</tr>
<tr>
<td>1.2 Dalabon</td>
<td>1</td>
</tr>
<tr>
<td>1.3 Intonation</td>
<td>2</td>
</tr>
<tr>
<td>1.4 The ‘word’</td>
<td>3</td>
</tr>
<tr>
<td>1.5 The grammatical word</td>
<td>3</td>
</tr>
<tr>
<td>1.6 The phonological word</td>
<td>3</td>
</tr>
<tr>
<td>1.6.1 Criteria for the phonological word</td>
<td>4</td>
</tr>
<tr>
<td>1.7 Prosodic domains</td>
<td>5</td>
</tr>
<tr>
<td>2 The ‘word’ in Dalabon</td>
<td>7</td>
</tr>
<tr>
<td>2.1 The grammatical word in Dalabon</td>
<td>7</td>
</tr>
<tr>
<td>2.2 The phonological word in Dalabon</td>
<td>9</td>
</tr>
<tr>
<td>2.2.1 Phonological rules</td>
<td>10</td>
</tr>
<tr>
<td>2.2.2 Phonotactic generalisations</td>
<td>10</td>
</tr>
<tr>
<td>2.2.3 Minimality constraints</td>
<td>11</td>
</tr>
<tr>
<td>2.2.4 The prosodic feature stress</td>
<td>12</td>
</tr>
<tr>
<td>2.2.5 The orthographic word</td>
<td>14</td>
</tr>
<tr>
<td>3 Methods and Materials</td>
<td>16</td>
</tr>
<tr>
<td>3.1 Labelling</td>
<td>16</td>
</tr>
<tr>
<td>3.1.1 Utterance tier</td>
<td>17</td>
</tr>
<tr>
<td>3.1.2 Word tier</td>
<td>17</td>
</tr>
<tr>
<td>3.1.3 Gloss tier</td>
<td>18</td>
</tr>
<tr>
<td>3.1.4 Break tier</td>
<td>18</td>
</tr>
<tr>
<td>3.2 Break indices</td>
<td>18</td>
</tr>
<tr>
<td>4. Results</td>
<td>21</td>
</tr>
<tr>
<td>4.1 Breaks</td>
<td>21</td>
</tr>
<tr>
<td>4.1.1 Intonation of constituents marked by break indices</td>
<td>22</td>
</tr>
<tr>
<td>4.1.2 Distribution of break indices</td>
<td>25</td>
</tr>
<tr>
<td>4.1.3 Pitch values for break indices</td>
<td>27</td>
</tr>
<tr>
<td>4.2 Pause duration</td>
<td>31</td>
</tr>
<tr>
<td>4.3 Non-isomorphic constituents</td>
<td>34</td>
</tr>
<tr>
<td>4.3.1 Reattached units</td>
<td>35</td>
</tr>
<tr>
<td>4.3.2 Isolated units</td>
<td>39</td>
</tr>
<tr>
<td>4.3.3 Pauses within words</td>
<td>43</td>
</tr>
<tr>
<td>4.4 Detached units</td>
<td>48</td>
</tr>
<tr>
<td>4.4.1 Closed syllables</td>
<td>48</td>
</tr>
<tr>
<td>4.4.2 Open syllables</td>
<td>50</td>
</tr>
<tr>
<td>5 Discussion</td>
<td>52</td>
</tr>
</tbody>
</table>
5.1 Breaks ............................................................................................................................ 52
5.2 Pause durations .............................................................................................................. 56
5.3 Non-isomorphic constituents ........................................................................................ 57
5.4 Detached prefix environments ..................................................................................... 58
6 Conclusion ......................................................................................................................... 60
References ......................................................................................................................... 62
Appendix ............................................................................................................................. 66
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Abstract

This study aims to contribute to the intonational studies of polysynthetic and Australian languages through the study of the dying Australian language Dalabon spoken in Arnhem Land. A major aim in this study is to investigate the nonisomorphism of the grammatical and the phonological word in Dalabon through the investigation of pause location and intonational contours. The study is based on collected tape recordings of the spontaneous speech of two Dalabon speakers totalling 30 minutes in duration. Recordings were digitised and labelled using the EMU speech database system on four tiers: the utterance tier, the word tier, the gloss tier, and the break tier. The break tier was labelled using modified ToBI transcription conventions. Findings of this study reveal that the intonational patterns of Dalabon share aspects of intonational universals. The investigation of the mismatch of the grammatical and the phonological word in Dalabon reveal consistencies regarding the location in which segmentation of grammatical words may occur. These findings suggest that speakers of Dalabon are capable of segmenting grammatical words into smaller units of coherence.
## Phoneme inventory and orthographic conventions

The following is adapted from Evans (2003: Lecture handout).

### CONSONANTS

<table>
<thead>
<tr>
<th>PERIPHERAL</th>
<th>APICAL</th>
<th>LAMINAL</th>
<th>PERIPHERAL</th>
<th>GLOTTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bilabial</td>
<td>Apico-alveolar</td>
<td>Apico-post-alveolar (retroflex)</td>
<td>Lamino-palatal</td>
<td>Dorso-velar</td>
</tr>
<tr>
<td>Short stop</td>
<td>p (b)</td>
<td>t (d)</td>
<td>d (rd)</td>
<td>c (dj)</td>
</tr>
<tr>
<td>Long stop</td>
<td>p: (bb)</td>
<td>t: (dd)</td>
<td>d: (rdd)</td>
<td>c: (djj)</td>
</tr>
<tr>
<td>Nasal</td>
<td>m (m)</td>
<td>n (n)</td>
<td>n (rn)</td>
<td>n (nj)</td>
</tr>
<tr>
<td>Lateral</td>
<td>l (l)</td>
<td>r (rr)</td>
<td>l (r)</td>
<td>j (y)</td>
</tr>
<tr>
<td>Trill</td>
<td>w (w)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approximant fricative</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### VOWELS

<table>
<thead>
<tr>
<th>FRONT</th>
<th>BACK</th>
</tr>
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<tbody>
<tr>
<td>High</td>
<td>i</td>
</tr>
<tr>
<td>mid</td>
<td>e</td>
</tr>
<tr>
<td>low</td>
<td></td>
</tr>
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</table>
## Abbreviations

<table>
<thead>
<tr>
<th>Abbr.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>/</td>
<td>[subject] acting upon [object]</td>
</tr>
<tr>
<td>1</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; person (exclusive)</td>
</tr>
<tr>
<td>12</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; person (inclusive)</td>
</tr>
<tr>
<td>2</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt; person</td>
</tr>
<tr>
<td>3</td>
<td>3&lt;sup&gt;rd&lt;/sup&gt; person</td>
</tr>
<tr>
<td>Adj</td>
<td>Adjective</td>
</tr>
<tr>
<td>APPR</td>
<td>Apprehensive</td>
</tr>
<tr>
<td>BEN</td>
<td>Benefactive (applicative)</td>
</tr>
<tr>
<td>COM</td>
<td>Comitative</td>
</tr>
<tr>
<td>CONJ</td>
<td>Conjunction</td>
</tr>
<tr>
<td>DEM</td>
<td>Demonstrative</td>
</tr>
<tr>
<td>dis</td>
<td>Disharmonic</td>
</tr>
<tr>
<td>du</td>
<td>Dual</td>
</tr>
<tr>
<td>FUT</td>
<td>Future</td>
</tr>
<tr>
<td>GEN</td>
<td>Genitive</td>
</tr>
<tr>
<td>HES</td>
<td>Hesitation</td>
</tr>
<tr>
<td>INST</td>
<td>Instrumental</td>
</tr>
<tr>
<td>IRR</td>
<td>Irrealis</td>
</tr>
<tr>
<td>LOC</td>
<td>Locative</td>
</tr>
<tr>
<td>NEG</td>
<td>Negative</td>
</tr>
<tr>
<td>O</td>
<td>Object (pronominal clitic)</td>
</tr>
<tr>
<td>Pause</td>
<td>Standard pause</td>
</tr>
<tr>
<td>Pausehes</td>
<td>Disfluency pause</td>
</tr>
<tr>
<td>Pauseww</td>
<td>Pause within a word</td>
</tr>
<tr>
<td>Pcust</td>
<td>Past customary</td>
</tr>
<tr>
<td>PI</td>
<td>Past imperfective</td>
</tr>
<tr>
<td>pl</td>
<td>Plural</td>
</tr>
<tr>
<td>Possd</td>
<td>Possessed by (after symbol(s)) indicating person / number of possessor</td>
</tr>
<tr>
<td>PP</td>
<td>Past perfective</td>
</tr>
<tr>
<td>PR</td>
<td>Present (also used with apprehensives, and imperatives)</td>
</tr>
<tr>
<td>R</td>
<td>Realis</td>
</tr>
<tr>
<td>REDUP</td>
<td>Reduplication</td>
</tr>
<tr>
<td>RR</td>
<td>Reflexive / reciprocal</td>
</tr>
<tr>
<td>S</td>
<td>Intransitive subject (not usually included, except to emphasise where prefix form is intransitive)</td>
</tr>
<tr>
<td>SEQ</td>
<td>Sequential</td>
</tr>
<tr>
<td>SUB</td>
<td>Subordinate</td>
</tr>
</tbody>
</table>
1 Preliminaries

1.1 Aims of this study

This study has two aims: to contribute to the intonational studies of Australian and polysynthetic languages, and to examine the non-isomorphism between the grammatical and phonological word in Dalabon. The non-isomorphism between the grammatical and the phonological word will be explored using the criterion of potential pause. Within this study, it will be shown that, in Dalabon, the domain of the phonological word may be equal to, smaller and larger than the terminal element of a syntactic tree (i.e. the grammatical word). This area of study has recently been explored in polysynthetic languages in publications such as *Studies on the Phonological Word* (Hall, 1999) and *Word* (Dixon & Aikhenvald, 2002). Dalabon, however, has previously received little attention in this particular area and as such this study must be considered a pilot study.

1.2 Dalabon

Dalabon is today a dying language spoken in Arnhem Land in Australia by less than twenty speakers. It is an agglutinating polysynthetic language belonging to the Gunwinyguan family, which is a non-Pama-Nyungan language.

Previous studies of Dalabon include Capell’s grammar (1962), Alpher’s (1982) and Evans, Brown and Corbett’s (2001) study of pronominal prefix encoding, Fletcher and Evan’s study of accentual prominence (2002), and Fletcher & Evans study of the phonological word (Ms). However, a comprehensive grammar of the language is lacking and many aspects of the phonology have not yet been investigated.

Grammatical words in Dalabon contain a sequence of ordered slots that may, but need not be filled by elements. For the most part these strings of elements form a single phonological word. However, there are exceptions to this assumption, which affect certain elements within the verbal word. For example the pronominal prefix may detach from the verbal word.
When the pronominal prefix becomes detached from the grammatical word, one of two things may occur. Firstly, the pronominal may form its own phonological word, as is clearly demonstrated by the existence of a notable pause to either side of the pronominal. Secondly, the pronominal may attach to the preceding grammatical word without any notable pause separating the two. The existence of a measurable pause between the pronoun and the following verb construction in conjunction with the location of intonational accents is the founding evidence that the pronominal prefix may form its own prosodic constituent.

1.3 Intonation

The study of intonation has previously focused on European languages such as English, Dutch and Swedish, whilst non Indo-European languages, in particular polysynthetic languages, have received relatively little attention up until recent times. Previous studies of the intonation of polysynthetic languages have examined Cayuga (Dyck, 2001), Lushootseed (Beck, 1999) and Unangan (Taff & Rozelle, 2001). Previous studies of the intonation of Australian languages have examined Dyirbal (King, 1994, 1999), Iwaidja (Birch, 1999, 2002), Kayardild (Fletcher, Evans & Round, 2002), and Bininj Gun-wok (Fletcher & Evans 2002; Bishop, 2002), which is closely related to Dalabon.

Previous studies of the pitch patterns of Dalabon have revealed that intonational phrases resemble the typical ‘hat-pattern’ (Fletcher & Evans, 2002:138). The ‘hat-pattern’, as described in traditional Dutch models of intonation (e.g. Cohen & t’Hart 1967), consists of one or two peaks with an initial rise into the first peak at the left edge of the constituent and a final fall at the right edge of the constituent. This pattern has also been documented in the closely related language varieties of Bininj Gun-wok (Fletcher & Evans, 2000; Bishop & Fletcher, in press; Bishop, 2002).
1.4 The ‘word’

The ‘word’ has been generally assumed to describe the most basic unit of language. Sapir defined the word as ‘one of the smallest, completely satisfying bits of isolated “meaning” into which the sentence resolves itself’ (Sapir, 1921). Such a definition falls short, however, considering the complexities that arise when attempting to describe the unit ‘word’ cross-linguistically from synthetic to polysynthetic languages.

The problems encountered defining the ‘word’ as a general unit may be circumvented by employing the terms phonological word and grammatical word, which need not necessarily be isomorphic with each other. In certain languages a grammatical word may consist of more than a single phonological word, whilst in other languages a phonological word may consist of more than a single grammatical word. A further possibility is that a grammatical word may consist of all of one grammatical word and part of another phonological word (Dixon & Aikhenvald, 2002:1). The following sections will contend with the issues of defining the phonological word and the grammatical word.

1.5 The grammatical word

The grammatical word is the result of the interface between morphology and syntax. Dixon & Aikhenvald (2002:19) define the grammatical word as consisting of a number of grammatical units (i.e. morphemes) which: a) always occur together, b) occur in a fixed order, and c) have a conventionalised coherence and meaning. Further criteria for determining the grammatical word include completeness of utterance as well as positioning of inflectional material at grammatical word boundaries. Thus the task of defining the grammatical word is relatively straightforward.

1.6 The phonological word

The phonological word is defined by Nespor & Vogel as ‘the lowest constituent of the prosodic hierarchy (to be discussed in section 1.8) which is constructed on the basis of mapping rules that make substantial use of nonphonological notions’ (1986:109). The
phonological word is the level of the prosodic hierarchy that represents the mapping between the morphological and grammatical components of the language. Thus, the boundaries of the phonological word must align with the boundaries of morpho-syntactic constituents.

The phonological word need not necessarily be isomorphic with the grammatical word. The basic possibilities for the domain of the phonological word are that it is larger, smaller, or equal to the terminal element of a syntactic tree (Nespor & Vogel, 1986:110). Previous studies on the phonological word have revealed that in some languages the phonological word may consist of more than a single grammatical word – for example a grammatical word + clitic as in Dutch (Booij, 1996). Alternatively a grammatical word may consist of more than a single phonological word – as found in the polysynthetic language Cree, where the verbal word consists of two phonological words with the preverb forming its own separate phonological word (Hall, 1999). Within this study, it will be shown that, in Dalabon, the domain of the phonological word may be equal to, smaller and larger than the terminal element of a syntactic tree.

1.6.1 Criteria for the phonological word

According to Hall (1999:3), the case for a phonological word is motivated by phonological generalisations, which may be divided into three types. These are: a) the domain of phonological rules, b) the domain of phonotactic generalisations and c) the domain for minimality constraints.

Dixon and Aikhenvald (2002:13) state that the phonological word is a phonological unit larger than the syllable which has at least one phonological defining property from the following areas: a) Segmental features – e.g. pause phenomena, b) prosodic features – e.g. stress placement, and c) phonological rules – e.g. sandhi processes.
The phonological word may be defined in a given language using a selection of the above criteria, which may vary according to the language in question. The application, or rather the failure, of these criteria to Dalabon will be discussed in the section 2.2.

1.7 Prosodic domains

The theory of prosodic domains, as developed by Selkirk (1984), and Nespor and Vogel (1986) represents the phonological relationship between the elements of syntactic structure. Each prosodic constituent is a domain where the application of specific rules is bound (Nespor, 1999:118). These constituents therefore determine the phonetic realisation of speech. According to Nespor and Vogel, prosodic domains, which are the basis for phonological rules, etc., are somewhat independent from syntax. For the most part prosodic constituents are isomorphic with morphosyntactic constituents, but this is not a requirement. Instead, prosodic domains draw on both phonological and nonphonological criteria. Thus the prosodic hierarchy provides an arena in which reference is made not only to morpho-syntactic structure, but also to other syntactic as well as semantic notions. The mapping rules used to define each prosodic domain have ‘a degree of variation across languages which is greater than that of the category directly above it in the hierarchy’ (Nespor and Vogel,1986:5).

Prosodic domains are arranged hierarchically, with the utterance dominating at the top and the syllable at the bottom. Several co-existing theories of the prosodic domains exist, that differ slightly in which domains are represented (Shattuck-Hufnagel & Turk, 1996:206). See Figure 1.1 for a comparison of hierarchical models.
The need for each of the prosodic domains stated above has since been widely discussed in the literature. For example, the clitic group is not considered a prosodic domain by several authors and has since been abandoned as a prosodic domain (Hall, 1999:9). Thus the relevant prosodic domains for a given language may vary, as will the determining criteria for those domains. Further investigation of prosodic domains is needed to determine whether the criteria for these domains exist cross-linguistically.

Within the theory of prosodic hierarchy the *strict layer hypothesis*, as formulated by Selkirk (Selkirk 1984), states that within the hierarchy of prosodic domains any domain at a given level consists exclusively of domains at the next lower level of the hierarchy. The *strict layer hypothesis* thus excludes recursivity of domain levels as well the skipping of domain levels. It should be noted that several authors contend with the *strict layer hypothesis* stating that it may be violable (see Hall, 1999:11).

This study will make significant use of the notion of prosodic domains as the non-isomorphism between the grammatical word and the phonological word is explored. Based on the analysis of data, the prosodic domains which are relevant in Dalabon will be discussed, just as certain other prosodic domains will be determined to be irrelevant in Dalabon.
2 The ‘word’ in Dalabon

This section will investigate the status of the grammatical word and the phonological word in Dalabon by looking at which criteria may apply to assist in defining these terms. As stated above the criteria for ‘wordhood’ may vary depending on the language in question.

2.1 The grammatical word in Dalabon

The template for the verbal word in Dalabon is given in Figure 2.1.

<table>
<thead>
<tr>
<th>Object proclitic</th>
<th>Subject/Object</th>
<th>Subordinate</th>
<th>Sequential</th>
<th>Status</th>
<th>Cause</th>
<th>Various adverbial</th>
<th>Benefactive/Instrumental</th>
<th>Various adverbial</th>
<th>Incorporated body part nominal</th>
<th>Incorporated generic nominal</th>
<th>Number/spatial</th>
<th>Comitative</th>
<th>Reflexive/reciprocal</th>
<th>Tense/aspect/mood</th>
<th>Case enclitic</th>
</tr>
</thead>
<tbody>
<tr>
<td>(-12)</td>
<td>(-11)</td>
<td>(-10)</td>
<td>(-9)</td>
<td>(-8)</td>
<td>(-7)</td>
<td>(-6)</td>
<td>(-5)</td>
<td>(-4)</td>
<td>(-3)</td>
<td>(-2)</td>
<td>(-1)</td>
<td>0 (+1)</td>
<td>(+2)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 2.1. Template structure of the verbal word in Dalabon

The shaded slots in Figure 2.1 represent units which may potentially be fused together. Optional slots are shown in brackets. Object pronominal encoding in Dalabon presents a variety of complexities. There are three basic possibilities for object encoding: a) the subject/object combination may be represented by a special portmanteau form, b) the object pronominal may be realised as a free pronoun positioned to the left of the subject pronominal, or c) the object pronominal may be realised as a reduced form of the object...
pronoun which may merge with the subject pronominal (Evans, Brown & Corbett, 2001; Evans & Fletcher, Ms).

Within the verbal word other slots may be filled by incorporated nominals and adjectives. A verbal word with all of the slots filled is, however, uncommon. An intransitive verbal word minimally consists of the verb root, the TAM, and the subject pronominal. A transitive verbal word minimally consists of the verb root, the TAM, and the subject/object pronominal. A transitive verbal word where the subject/object combination is represented by a portmanteau form is shown in 1).

1) yila-h-ngu-n
   1pl/3-R-eat-PR
   ‘We eat it’ (Tape1a10m32s)

As can be seen in Figure 2.1) the pronominal prefixes, (which form the basis of this study), fulfill the criteria of the grammatical word in Dalabon as they must occur together with certain morphemes, and they must occur in a fixed order. For these reasons, the pronominal prefixes must therefore be analysed as belonging to the verbal word of Dalabon.

The characteristics of the verbal word in Dalabon essentially meet the definition of the grammatical word given in Section 1.3, though there are some exceptions. The rule of fixed ordering (given in section 1.5) is violable in Dalabon in certain instances. For example, the sequential morpheme ‘yelung’, when in its shortened form ‘lng’, typically precedes the status realis marker as shown in 2).

2) ka-h-lng-kolhdu-burlhmu-ø
   3-R-SEQ-new.sprouts-emerge-PR
   Then new sprouts emerge (Tape1a30m2s)

Though when in its underlying form ‘yelung’ the sequential marker follows the realis marker, as in 3)
3) bulu-ka-h-\textit{yelung}-rdarrhm-inj
   3pI0-3-R-SEQ-distrust-PP
   ‘He distrusted them’ (Tape8b4m10s)

The rule of conventionalised coherence also presents some difficulties in Dalabon as speakers are capable of segmenting complex words into smaller phonological units—as is the case when the pronominal prefix detaches from the verbal word. This is shown in 4).

4) ka-h-\textit{lng} [222.4ms] maryahm-inj
   3-R-SEQ get.lost-PI
   ‘Then he got lost’ (Tape7b28m2s)

Where segmentation of complex words occurs, the sequence containing the pronominal prefix, sequential, causal and status markers must never be separated. Likewise, the sequence containing the comitative applicative marker, the root, the reflexive/reciprocal and TAM markers must never be separated (Evans & Fletcher, Ms). This suggests that despite the violation of the conventionalised coherence rule, Dalabon speakers segment sequences of words within the verbal word in a structured manner.

The criterion of completeness of utterance is clearly satisfied by the verbal word of Dalabon as the morphological complexity of the verbal word allows an entire phrase to form its own complete utterance. Likewise, the criterion of inflectional material located at the grammatical word boundary is satisfied, as the verbal word must be encircled by the pronominal prefix at the left edge and the TAM suffix at the right edge (see Figure 2.1).

\section*{2.2 The phonological word in Dalabon}

Of the criteria used to define the phonological word discussed in section 1.7, only potential pause assists in defining the phonological word in Dalabon. The reasons are that Dalabon displays no significant morphophonemic rules, that phonotactic constraints apply at the syllable and morpheme levels rather than the word level, and that the minimality constraint applies to the root rather than the phonological word (Evans & Fletcher, Ms). Nor does the
prosodic feature stress assist in defining the phonological word, as stress placement within the verbal word is inconsistent. The following sections will examine how these criteria fail to assist in defining the phonological word in Dalabon. For these reasons, the criterion of potential pause will be exclusively used to define the phonological word in Dalabon.

The interruptability of a grammatical word at certain locations may offer insight into how speakers mentally segment sequences of speech. The location of potential pause has been used as a diagnostic to determine the prosodic status of preverbs as phonological words in the polysynthetic language Cree (Hall, 1999). Pause has also been used to define the phonological word in Cup’ik (Woodbury, 2002), though pause has also been used to define the phonological phrase in Italian (Payne, 2000) and the intonational phrase in Lushootseed (Beck, 1999). In this study, the prosodic constituent delineated by pause will provisionally be referred to as the phonological word. However in section 5.1.1, I will discuss whether this constituent is better viewed as belonging to a higher level of the prosodic hierarchy such as the phonological phrase.

2.2.1 Phonological rules

Morphophonemic rules in Dalabon are rare, as morphemes are typically strung together whilst maintaining their underlying representation in their surface representation. The most widespread morphophonemic rule is the systematic shortening of the sequential marker ‘yelung’ to ‘lng’ when following a pronominal prefix. See 5).

5) ka-h-lng-kolk-do-n
   3-R-SEQ-water-dry.up-PR
   ‘The water dries up’ (Tape6a8m44s)

2.2.2 Phonotactic generalisations

Phonotactic constraints in Dalabon mainly concern the placement of phonemes within the syllable structure. The few phonotactic constraints on the phonological word restrict the trilled r (orthographically rr) and long stops to only occur word-internally (see 6)).
Constraints regarding the edges of a phonological word restrict the glottal stop (orthographically h) from occurring word-initially. See 6).

6) **bamurru** **kanh** yala-yi-n
    magpie.goose DEM 1pl-say-PR
    ‘We say magpie goose’ (Tape1a39m29s)

However, as the units that form the basis of this study always align with morpheme boundaries, these constraints are unhelpful in defining the phonological word in Dalabon.

### 2.2.3 Minimality constraints

The basic syllable in Dalabon has the structure CV(C)(C)(C). Figure 2.2 shows the possibilities for the basic syllable structure of Dalabon where C may be any consonant except /, V is any vowel or diphthong, L is any liquid (l, rl, r, or rr), N is any nasal (m, n, rn, nj, or ng, though restricted to ng after L), and S is a peripheral stop (k, b) (Evans, 2003). See also Dalabon phoneme inventory.

\[
\begin{array}{ccc}
C & V & (L) \\
   &   & (N) \\
   &   & (?, ?) \\
   &   & (L) \\
   &   & (S)
\end{array}
\]

Figure 2.2. Basic syllable structure of Dalabon

Syllable boundaries virtually always coincide with morpheme boundaries except for in two parts of the verbal word. These are: a) the TAM suffixes, which may form part of the rhyme or coda of the verb root, and b) the realis, subordinate and sequential morphemes, which may form the coda of the pronominal prefix. In 7) the realis marker forms the coda of the pronominal prefix, while the TAM marker forms the coda of the verb root.

7) **ka-h-ru-ng**
    3/3-R-burn-PR
    ‘It burns it’ (Tape1a5m17s)
In the following sections, both these locations will be shown to potentially precede phonological word boundaries.

The minimal phonological word in Dalabon may be monosyllabic, provided that it has the syllable structure of CVC. Monosyllabic open syllables are therefore non-permissible as phonological words in Dalabon, due to the bimoraic minimum, except for some interjections such as ‘nja’ meaning ‘here you are’. In this study it will be shown that the constraints on the minimal phonological word also apply to detached units.

### 2.2.4 The prosodic feature stress

The prosodic feature stress is considered an important criterion for determining the status of the phonological word (Hall, 1999:4). A pronominal prefix in Dalabon always receives stress placement –typically primary stress, however secondary stress is also seen. 8) shows a verbal word where the prefix receives primary stress and the verb root receives secondary stress.

8)    djá-h-yînm-iyan  
2/3-R-say-IRR  
‘you would say it’

Figure 2.3. Rms track showing stress placement (Tape5b4m31s)
Alternatively, the pronominal prefix may receive secondary stress of the verbal word as illustrated in 9).

9) ngà-h-n-íyan
   1-R-see-FUT
   ‘I will see’

Figure 2.4. Rms track showing stress placement Tape1a26m1s

10) illustrates a typical stress pattern of Dalabon where almost every syllable of every foot receives stress.

10) wúh buká-h-márnu-djóng-yúrdká-ng kánh
    lest 3/3-R-BEN-afraid-cause.to.run.away-PP DEM
    ‘Lest they scared him and made him run away’
The basic possibilities for stress placement of the verbal word in Dalabon is illustrated in 8) to 10) above. A single phonological word may thus receive one or more stresses. However, pronominal prefixes always attract at least a secondary stress. As stress placement within the verbal word in Dalabon is inconsistent, the prosodic feature stress does not assist in defining the phonological word.

2.2.5 The orthographic word

The orthographic word may assist in determining the psychological validity of words for speakers. Where a non-isomorphism exists between the phonological word and the grammatical word, the position where a space or hyphen is inserted between units may reveal how a speaker ‘chunks’ units together. Word boundaries are often placed around the larger unit. Where a single grammatical word consists of two phonological words, no space is inserted between those two units. Likewise, where a phonological word consists of two grammatical words, no space will be inserted between those two units (Dixon & Aikhenvald, 2002:30).

Owing to the lack of literate speakers, these practices do not assist in distinguishing between grammatical and phonological words in Dalabon. Furthermore, the orthographic tradition of Dalabon is relatively new, having been developed within the last couple of
decades. Orthographic conventions for writing word boundaries have not been stabilised and a great deal of variation exists regarding the use of spaces and hyphens by both linguists and speakers (Fletcher & Evans, Ms).
3 Methods and Materials

The corpus of data used for this research was collected by Nicholas Evans on several field trips to Arnhem Land between 1992 and 2002. The corpus, which consists of the spontaneous speech of two different Dalabon speakers, was collected in the form of audiocassette recordings. The spontaneous nature of the corpus makes it possible to analyse non-artificial speech (i.e. not spoken in a laboratory or an unnatural environment). Ladefoged (1997) claims that recorded spontaneous narratives provide the best data for analysis of intonation and prosody. It is also clearly preferable to analyse the speech of more than one speaker in order to make a sound analysis of the phenomenon in question.

The discourse type of recorded speech varied for the two speakers used in this study. The data of speaker A (Maggie Tukumba) was recorded in connection with a dictionary check and is therefore interactional in nature, while the data of speaker B (Jack Chattam) consists solely of narratives and is therefore non-interactional in nature. The difference between these two types of discourse may have differing effects on the prosodic structure of utterances (Yaeger-Dror, 2002). For this reason the f0 statistical results were extracted separately for the two speakers.

The audiocassette recordings were digitised in segments ranging from 7 to 50 seconds in duration, totalling 30 minutes. The digitised segments were not randomly chosen, but aimed to capture as many instances as possible of the phenomenon of prefix detachment. Recordings were digitised at 22.05 kHz using ESPS/Waves+ on a Sun Ultra workstation. The digitised segments were then labelled using the EMU Speech Database System, Version 1.2 (cf. Cassidy and Harrington, 2001). Statistics were calculated using the statistical package R version 1.6.2 (Millar, Harrington & Vonwiller, 1997).

3.1 Labelling

The digitised segments were labelled on four tiers. These were the utterance tier, the word tier, the break tier and the gloss tier. Figure 3.1 shows an example of a labelled utterance.
11) yila-h-dja-bo-nj  malung  ka-h-ru-ng  kerri  kanh
1pl-R-just-go.around-PR  before  3-R-be.burned-PR  ground.oven  DEM
‘We just go around before it is burnt in the ground oven’

<table>
<thead>
<tr>
<th>Utterance</th>
<th>Word</th>
<th>Break</th>
<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>yila-h-dja-bo-nj</td>
<td>malung</td>
<td>ka-h-ru-ng</td>
<td>kerri kanh</td>
</tr>
</tbody>
</table>

Figure 3.1. Example of a labelled utterance (Tape1a1m59s)

Details of the labelling conventions used in this study are given in the following sections.

### 3.1.1 Utterance tier

On the utterance tier, segments of continuous speech uninterrupted by a pause were labelled orthographically using spectrograms and the f0 signal to delineate words and pauses. For the purpose of this study a juncture of 200ms or more was labelled as a pause (Butcher, 1981). At this level of labelling no distinction was made between the types of pause.

### 3.1.2 Word tier

On the word tier, grammatical words were orthographically labelled individually. Morpheme boundaries were indicated using hyphens.

On the word tier, silent pauses were divided into three categories and labelled accordingly. These were: standard pauses, disfluency pauses, and pauses within a word. Standard pauses are pauses that occur between grammatical units. Disfluency pauses occur in connection with repetition, deletion or substitution of units, such as pronominal prefixes, which should otherwise be attached to a following verbal unit. Pauses within a word are a clear example of an interruption of a grammatical word. As such, these are the clearest example of a non-isomorphism between a grammatical word and a phonological word. Disfluency pauses differ from this type of pause, as the unit preceding a pause is either repeated or changed to
a different unit. The latter two categories of pause have in common that the preceding constituent must attach to another constituent to form a complete grammatical word. For the purpose of this study 200 ms was considered the minimum length of a pause as the phonemic inventory of Dalabon includes long voiceless stops (Fletcher & Evans, 2002:124), which might otherwise incorrectly be construed as a silent pause.

3.1.3 Gloss tier
Due to the morphological complexity of Dalabon, the gloss tier was labelled morphologically. This enabled a better understanding of the semantic and syntactic structure of the data, as the author responsible for labelling and glossing the data is not a native speaker of the language.

3.1.4 Break tier
At the break level, breaks were labelled using modified ToBI transcription conventions (e.g. Beckman & Ayers Elam, 1997; Fletcher & Evans, 2002). See section 3.2 below for a full description of how break indices were used in this study.

3.2 Break indices
ToBI was originally developed for the transcription of three dialects of English; general American, standard Australian and British English (Beckman & Ayers Elam, 1997) and has since been modified to apply to typologically unrelated languages such as Bininj Gun-wok (Bishop, 2002; Bishop & Fletcher, in press). ToBI consists of at least two different levels of prosodic annotation: the tonal level and the break level. Due to the limited scale of this study and the focus on prosodic constituency, breaks alone were labelled. In this study break indices were given on purely phonetic grounds (to be discussed below in Sections 3.2.1 to 3.2.5) entailing that the morpho-syntax of Dalabon was not taken into consideration when labelling break indices.
The breaks indices component of ToBI measures perceived prosodic juncture between constituents using the four labels; 0, 1, 3 and 4, where 0 marks the lowest degree of perceived juncture and 4 marks the highest degree of perceived juncture. The label 2 is given only to indicate uncertainty as to the nature of the perceived juncture in question.

### 3.2.1 Break Index 0

The break index 0 is used to indicate the presence of morphophonemic rules where the boundary between two grammatical words is either phonetically elided or reanalysed in fast speech. This label should only be used where it is not possible to distinguish the original word boundary auditorily, otherwise a break index 1 should be given.

As discussed in section 2.2.1 Dalabon displays very few morphophonemic rules. Instead, morphemes are usually strung together in their underlying forms without any processes of elision or reduction. The most common morphophonemic rule in the data reduces the sequential marker ‘yelung’ to ‘-Ing’ when following a pronominal prefix. Where this reduction occurs in the data, morphemes were labelled morpheme by morpheme. In these instances no 0 labels were given, as the few morphophonemic processes are very regular making original word boundaries easily distinguishable.

### 3.2.2 Break Index 1

The break index 1 is used to indicate a word boundary with a minimal degree of juncture. The final segment of one word and the initial segment of the following word can be clearly distinguished, as re-syllabification has not occurred. For purposes of convenience a constituent marked by a break index 1 will henceforth be referred to as a word according to ToBI conventions (e.g. Beckman & Ayers Elam, 1997).

### 3.2.3 Break Index 3

The break index 3 is given to indicate a greater perceived juncture than a break index 1 but less juncture than a break index 4. The cues indicating a break 3 juncture may consist of
one or more of the following; a brief juncture of no more than 200ms, lengthening or prominence of the final syllable, and pitch reset of the following constituent. A constituent marked by a break index 3 will henceforth be referred to as an intonational phrase. This is more in line with Gordon’s (1999) analysis of Chickasaw than conventionalised ToBI analyses of other languages.

### 3.2.4 Break Index 4

The break index 4 is given to mark the highest degree of perceived juncture. The phonetic cue indicating a break 4 constituent is a substantial pause of more than 200ms. A constituent marked by a break index 4 will henceforth be referred to as an utterance. Although longer pauses tend to mark a phrase with a sense of finality, this may not always be the case. It is therefore important to note that in this study, a break 4, given on the phonetic grounds of pause alone, may not necessarily denote an utterance with a sense of finality. As the occurrence of detached prefixes is investigated, it will become evident that a grammatical word may belong to two or three intonational phrases, based on the presence of pause, but that a sense of finality is not present.

### 3.2.5 Summary of break indices

Break indices allow the perceived degrees of prosodic juncture to be labelled. Phonetic cues assist in determining the correct degree of juncture; a break index 3 includes a brief juncture of no more than 200ms, lengthening or prominence of the final syllable and pitch reset of the following constituent, while the cues of a break index 4 include a substantial pause of more than 200ms.

The constituents marked by break indices have been matched to levels of the prosodic hierarchy. These are the domain of the word (break index 1), the intonational phrase (break index 3), and the utterance (break index 4). The utterance is the largest unit in the prosodic hierarchy with the largest span of application of phonological rules (Nespor & Vogel, 1986; Selkirk, 1978, 1980) and the boundaries of the utterance are the location of non-hesitation pauses (Hayes, 1989).
4. Results

The results section is divided into four main components: a) breaks, b) pause duration, c) non-isomorphic constituents, and d) detached units. The breaks section will explore intonational patterns evident in the data, as well as break index distributions, and f0 values for break indices. The pause duration section will analyse the results of the durations for the different pause types to examine any patterns evident between the types. The section regarding non-isomorphic constituents will explore patterns evident in the data concerning the non-isomorphism between the grammatical and phonological word looking at the pitch traces of these constituents and the preceding units. Finally, the detached segments section will examine the speech material that detaches from grammatical words as well as the surrounding environments in order to ascertain any possible tendencies regarding this phenomenon.

In the examples given, an underscore indicates the lack of a pause between grammatical constituents. Pause durations are given in milliseconds in square brackets.

4.1 Breaks

This section will look at the intonational contours of constituents marked by break indices, the number of break indices per intonational constituent, and the final pitch values of constituents marked by break indices. It is hypothesised that the intonational patterns of Dalabon share traits of intonational universals, as has been attested in the closely related varieties of Bininj Gun-wok (Bishop & Fletcher, in press; Bishop, 2002). It is hypothesised that an intonational phrase in Dalabon consists of relatively few words, as attested in the closely related varieties of Bininj Gun-wok (Bishop & Fletcher, in press). It is furthermore hypothesised that the final pitch values of constituents will differ depending on the break index given.
4.1.1 Intonation of constituents marked by break indices

In the data, a break index 1 is typically associated with a peak followed by a falling pitch movement at the right edge of the constituent. Intonational contours associated with a break index 3 consist of a sequence of break index 1 contours. The constituents marked by a break index 3 may display downtrends, so that each peak and each trough are successively lowered. Intonational contours associated with a break index 4 resemble those contours of a break index 3, however a final rising contour at the right edge may also be found. Figure 4.1 shows an example of a typical pitch contour of an utterance with falling pitch movement at the right-most edge.

12) djarrman_____nunh__kono__ka-h-yidnja-n ngurrungurmi-yi
tree.type DEM flower 3-R-have-PR become.red-PCust
‘This type of tree has flowers that become red’

Figure 4.1. Final falling pitch contour of an utterance (Tape1a37m45s.)

Figure 4.1 shows a verbal word with a pitch movement on the prefix and a separate pitch movement on the verbal root + suffixes, which is typical of a phonological word.

In Figure 4.2 the constituents marked by break indices consist of a peak followed by a trough at the rightmost edge of the constituent. The two pronominal prefixes are separated
from the remainder of the verbal word by disfluency pauses before the verbal word is uttered in its complete form.

13) morr__bulnu__nga-h [406ms] bulnu__nga-h [325ms] nga-h-ban-ø
   HES 3pIO 1-R 3pIO 1-R 1-R-leave-PR
   ‘them, I, them, I, I leave them’

Figure 4.2. Final falling pitch movement in four intonational phrases (Tape5a28m53s)

Figure 4.2 illustrates the downtrends evident in the data. In this example downtrends occur both within and across the intonational phrases with each peak and each trough becoming successively lower than the previous.

Figure 4.3 shows an utterance with a final rising pitch contour at the rightmost edge of the constituent.

14) be-ngan______ka-h-marnu-yiniy-an
    son-1Possd 3/3-R-BEN-say-PR
    ‘my son says it’
The occurrences of a final rising pitch movement were infrequent throughout the data.

Figure 4.4 displays a flat pitch contour, where the only notable movement is seen on the pronominal prefixes + realis marker ‘buka-h’, which all display a final fall at the rightmost edge.

15) buka-h-dja-m [200ms] men-werre-minj____buka-h-dja-kedjakm-inj____
    3/3-R-just-HES      mind-rub.out-PI      3/3-R-just-crush-PI

    dord___buka-h-marnu-nan-inj
    up      3/3-R-BEN-see-PI

    ‘It just erased his mind, it just crushed him up, they saw it’
Overall the intonational contours displayed subtle shifts in pitch movement. The fairly small degree of pitch movement common throughout the data will be discussed further in Section 4.1.3.

As illustrated in Figures 4.1 to 4.4 above, Dalabon displays both pitch movements with falling or rising contours as well as relatively flat pitch contours.

4.1.2 Distribution of break indices

As mentioned in Section 2.1, the morphological complexity of Dalabon allows a considerable amount of information to be encoded into a single grammatical word. Thus a single grammatical word in Dalabon may correspond to several words in a synthetic language. It was therefore hypothesised that an intonational phrase (break index 3) or utterance (break index 4) in Dalabon may consist of relatively few words (break index 1). The distribution of break indices in the data offers some insight into how many break 1 constituents are contained per break 3 and 4 constituent. Figure 4.5 shows a simplified distribution of the break indices.
In the data there are 939 occurrences of the break index 1, 189 occurrences of the break index 3, and 698 occurrences of the break index 4. On average an intonational phrase or utterance contains approximately 1.9 words. The distribution of sequences of break 1 indices per break 3 or 4 index is illustrated in Figure 4.6.

Figure 4.5. Distribution of break indices

Figure 4.6 reveals that an intonational phrase, as defined by a break index 3 or 4, contains minimally one (with 386 occurrences in the corpus) and maximally eight (with 1
occurrence in the corpus) words. Thus a typical intonational phrase in Dalabon consists of very few words.

4.1.3 Pitch values for break indices

A quantitative analysis of f0 values was carried out to determine whether the constituents marked by break indices showed similar patterns at the rightmost edge of the constituent. The f0 (Hz) values for the rightmost edge of a break constituent were extracted using EMU R (Millar, Harrington & Vonwiller, 1997).

All null f0 values were removed from the data. Null values arise where the pitch trace cannot be distinguished in the EMU labelling system due to poor recording quality or the position of the break index (e.g. creaky phonation or voiceless segments do not get a pitch trace) and therefore results in poorer accuracy of statistical procedures. As all null values were removed from the data the number of break indices in Table 4.1 below is slightly lower than in Figure 4.5 above. Table 4.1 shows the summary of f0 values for the break indices 1, 3 and 4 for speaker A (Maggie).

<table>
<thead>
<tr>
<th>Break Index</th>
<th>N</th>
<th>Min.</th>
<th>Median</th>
<th>Mean</th>
<th>Max.</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Break Index 1</td>
<td>873</td>
<td>56.76</td>
<td>167.90</td>
<td>162.30</td>
<td>308.00</td>
<td>38.42</td>
</tr>
<tr>
<td>Break Index 3</td>
<td>170</td>
<td>58.82</td>
<td>161.20</td>
<td>153.20</td>
<td>240.50</td>
<td>39.60</td>
</tr>
<tr>
<td>Break Index 4</td>
<td>648</td>
<td>58.58</td>
<td>152.10</td>
<td>153.30</td>
<td>307.3</td>
<td>37.65</td>
</tr>
</tbody>
</table>

Table 4.1. Summary of f0 values (Hz) for speaker A

Table 4.1 shows that the f0 value of a break index 1 for speaker A is higher than that of a break index 3, which in turn is higher than a break index 4.

Table 4.2 shows the summary of f0 values for the break indices 1, 3 and 4 for speaker B (Jack).
The f0 results for speaker B agree with those of speaker A, where the f0 value of a break index 1 is higher than that of a break index 3, which in turn is higher than that of a break index 4.

The minimum and maximum f0 values in Tables 4.1 and 4.2 reveal substantial differences between the speakers. The pitch range of speaker A has the lowest minimum (56.76 Hz) and the highest maximum (308 Hz). The unusually low f0 minimum of speaker A is attributed to creaky rather than modal phonation. A simplified distribution of the f0 ranges for both speakers was drawn to illustrate these differences. See figure 4.7.

Figure 4.7 reveals that the f0 values of speaker A show the widest range with approximately 250 Hz for the break indices 1 and 4, whilst the f0 range of speaker B lies comparatively stable for all break indices at approximately 140 Hz.
As the sample sizes of speaker B are relatively small making results less reliable, only the results of speaker A will be used for further analysis of f0 values.

A one-way ANOVA was performed to determine whether there was a significant difference between the f0 values for the break indices for speaker A.

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>break.labs</td>
<td>34445</td>
<td>2</td>
<td>17223</td>
<td>12.097</td>
<td>6.079e-06</td>
</tr>
<tr>
<td>Residuals</td>
<td>2403331</td>
<td>1688</td>
<td>1424</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4.3. One-way ANOVA of f0 values for break indices 1,3, and 4 for speaker A

The result of the one-way ANOVA was highly significant (p<6.079e-06) suggesting that there were significant differences between f0 values for the break indices. Post-hoc t-tests were carried out to determine where the difference lay. The results are shown in Table 4.4.

<table>
<thead>
<tr>
<th></th>
<th>t</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Break 1 and Break 3</td>
<td>2.7529</td>
<td>231.514</td>
<td>0.006376</td>
</tr>
<tr>
<td>Break 1 and Break 4</td>
<td>4.6342</td>
<td>1389.352</td>
<td>3.919e-06</td>
</tr>
<tr>
<td>Break 3 and Break 4</td>
<td>-0.0105</td>
<td>254.912</td>
<td>0.9917</td>
</tr>
</tbody>
</table>

Table 4.4. Post-hoc t-tests of break index f0 values for speaker A

The results of the post-hoc t-tests reveal that the significant difference lay with the break indices 1 and 4 (p<3.919e-06) as well as the breaks indices 1 and 3 (p<0.006376) suggesting that these break indices have different f0 values.

In the data, a constituent preceding a pause within a word never displays a final rising pitch movement, and of the 68 constituents preceding a disfluency pause, only three show a final rising pitch movement. Based on this observation, break 4 constituents were divided into two groups: a) those associated with an utterance-final constituent (i.e. those preceding a
standard pause), and b) those associated with a non-utterance-final constituent (i.e. those precendent a disfluency pause and pause within a word). Figure 4.8 shows a simplified distribution of the f0 values of utterance-final and non-utterance-final constituents. The outer ‘whiskers’ of the box-plots contain approximately 99.3% of the values. The midsection of the box indicates the mean of the f0 values for each constituent type, while circles denote the outliers.

Figure 4.8. Box-plots of utterance-final and non-utterance-final constituents respectively.

Figure 4.8 illustrates that utterance-final constituents generally have a lower f0 value than non-utterance-final constituents and that utterance-final constituents have more outliers with higher f0 values than non-utterance-final constituents.

The summary of f0 values for these two groups is given in Table 4.5.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Min.</th>
<th>Median</th>
<th>Mean</th>
<th>Max.</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-utterance-final constituent</td>
<td>74</td>
<td>54.53</td>
<td>119.00</td>
<td>126.70</td>
<td>247.10</td>
<td>44.73</td>
</tr>
<tr>
<td>Utterance-final constituent</td>
<td>401</td>
<td>54.08</td>
<td>103.40</td>
<td>116.10</td>
<td>318.60</td>
<td>48.57</td>
</tr>
</tbody>
</table>

Table 4.5. Summary of f0 values for non-utterance-final and utterance-final constituents
A t-test was performed to determine whether there was a significant difference between the f0 values for these two groups. Table 4.6 shows the results.

<table>
<thead>
<tr>
<th>Constituent types</th>
<th>T</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-1.8551</td>
<td>107.289</td>
<td>0.06633</td>
</tr>
</tbody>
</table>

Table 4.6. T-test of f0 values for non-utterance-final and utterance-final constituents

The result of the t-test was insignificant (p<0.06633), though close to significant at 0.05. Table 4.5 reveals only 10Hz difference between the constituent types suggesting that the f0 values for the non-utterance-final and utterance-final constituent types do not differ greatly.

4.2 Pause duration

This section will focus on the hypothesized criteria of the phonological word in Dalabon: potential pause. The durations of the three pause types will be examined and compared. It is hypothesized that pauses within words have a shorter duration than standard pauses.

An impressionistic overview of the pause types for both speakers reveals little difference between the pause durations of the speakers. A sample t-test was performed on the durations of disfluency pauses to confirm this assumption. The results are shown in Table 4.7.

<table>
<thead>
<tr>
<th>Speaker A and B disfluency pause</th>
<th>t</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.9434</td>
<td>5.538</td>
<td>0.1040</td>
</tr>
</tbody>
</table>

Table 4.7. T-test of disfluency pauses for speaker A and B

The result of the t-test was insignificant (p<0.1040) suggesting that there was no difference between the pause durations for the speakers. For this reason, the following pause duration results have been drawn from the combined results of speakers A and B.

A summary of the number and durations of the different pause types is shown in Table 4.8. The data used in this study were not randomly selected, but specifically aimed at capturing
occurrences of nonisomorphisms of the grammatical and the phonological word. For this reason the division of the pause types in Table 4.8 is not reflective of the overall frequency in real discourse.

<table>
<thead>
<tr>
<th>Pause type</th>
<th>N</th>
<th>Min.</th>
<th>Median</th>
<th>Mean</th>
<th>Max.</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pause within word</td>
<td>29</td>
<td>212.1</td>
<td>440.0</td>
<td>556.5</td>
<td>2963.0</td>
<td>527.25</td>
</tr>
<tr>
<td>Disfluency pause</td>
<td>68</td>
<td>200.0</td>
<td>468.3</td>
<td>683.6</td>
<td>2478.0</td>
<td>508.23</td>
</tr>
<tr>
<td>Standard pause</td>
<td>492</td>
<td>207.4</td>
<td>971.3</td>
<td>1122.0</td>
<td>6160.0</td>
<td>775.76</td>
</tr>
</tbody>
</table>

Table 4.8. Summary of the durations of different pause types for both speaker A and B

From Table 4.8 it becomes evident that the standard pause type is of a substantially longer duration (1122.0ms) to pauses within words (556.5ms) and disfluency pauses (683.6ms).

Figure 4.9 shows a simplified distribution of durations for disfluency pauses, pauses within words, and standard pauses respectively.

![Box plots of the durations for the different pause types](image)

Figure 4.9. Box plots of the durations for the different pause types

The outer ‘whiskers’ of the box plots contain 99.3% of the values. The midsection of the box indicates the mean of the durations for each pause type, while circles denote the
outliers. As the pause duration by definition (in this study 200ms or more is considered a pause) is no less than 200ms, the outliers will inevitably be of a longer duration. As expected, the box plots reveal that pauses within words and disfluency pauses have lower means than standard pauses. Standard pauses have the longest durations of outliers.

A one-way ANOVA was performed to determine whether there was a significant difference between the three pause types. Table 4.9. shows the results.

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pause.labs</td>
<td>18730175</td>
<td>2</td>
<td>9365088</td>
<td>17.119</td>
<td>5.947e-08</td>
</tr>
<tr>
<td>Residuals</td>
<td>320571795</td>
<td>586</td>
<td>547051</td>
<td></td>
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</tr>
</tbody>
</table>

Table 4.9. One-way ANOVA for pause durations

The results of the ANOVA were highly significant (p<5.947e-08) suggesting that there were clear differences between the durations for the different pause types. Post-hoc t-tests were carried out to determine where the significance lay. The results are shown in table 4.10.

<table>
<thead>
<tr>
<th></th>
<th>t</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disfluency pause &amp; pause within word</td>
<td>1.0989</td>
<td>51.226</td>
<td>0.2770</td>
</tr>
<tr>
<td>Disfluency pause &amp; standard pause</td>
<td>-6.1886</td>
<td>115.463</td>
<td>9.526e-09</td>
</tr>
<tr>
<td>Pause within word &amp; standard pause</td>
<td>-5.441</td>
<td>35.569</td>
<td>4.022e-06</td>
</tr>
</tbody>
</table>

Table 4.10. Post-hoc t-tests for the durations of the different pause types

The results of the post-hoc t-tests reveal that there was a highly significant difference in duration between pauses within words and standard pauses (p<4.022e-06), as well as disfluency pauses and standard pauses (p<9.526e-09), but that there was no difference in duration between disfluency pauses and pauses within words (p<0.2270).

The results presented above clearly indicate that standard pauses are of a longer duration than disfluency pauses and pauses within words.
4.3 Non-isomorphic constituents

In the Dalabon data where a grammatical word is non-isomorphic to the phonological word, one of two things may occur: a) the detached unit may stand alone with a pause to either side (henceforth ‘isolated units’), or b) the detached unit may form a phonological unit with the preceding unit (henceforth ‘reattached units’). Evidence for these two phenomena comes from pause locations and intonation patterns.

Table 4.11 shows the grammatical units which precede (where applicable) a detached unit in the data.

<table>
<thead>
<tr>
<th></th>
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<th>Detached unit</th>
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<tbody>
<tr>
<td>+4</td>
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<td></td>
<td></td>
<td>bala-h</td>
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<td></td>
<td>+3</td>
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<td></td>
<td>buka-h</td>
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<td>+2</td>
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<td>buka-h-dja-m</td>
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<td></td>
<td>+1</td>
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<td></td>
<td>ka-h-dja</td>
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<td>ka-h-dja-lng</td>
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<td>ka-h-lng</td>
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<td>nga-h-kom</td>
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<td>ngarra-h</td>
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<td>ngurra-h</td>
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<td>yawoyh-dorrng</td>
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<td>-yirri-kun-</td>
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<td>kardu</td>
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<td>bula-h</td>
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<td>ka-h</td>
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<td>yala-h</td>
</tr>
</tbody>
</table>

Table 4.11. A full list of the grammatical words preceding a detached unit
Of the 29 examples of a detached unit, 12 stand isolated and 17 attach to a previous phonological unit consisting of up to four grammatical words.

### 4.3.1 Reattached units

Where a detached unit is not separated from the preceding unit by a pause, the detached unit forms a phonological unit with the preceding unit. A detached unit may form an intonational phrase with a single grammatical word provided that it is disyllabic, or monosyllabic and super heavy. The following section will examine the pitch contours of reattached units as well as which grammatical units these attach to.

In 4.10) the detached unit reattaches to the previous grammatical word ‘kardu’ forming an intonational phrase.

16) kardu__bala-h [213ms] yirri-kun [467.8ms] bon-inj
   maybe 3pl-R spread.out-by.oneself travel-PI

‘Maybe they travel spread out by themselves’

![Figure 4.10. Pitch contour of a reattached unit (Tape6b4m37s)](image-url)
In 4.11 the detached unit forms an intonational phrase with the preceding grammatical word – the demonstrative ‘kanh’. In the data, this is the only example of a detached unit reattaching to a single grammatical word that is monosyllabic.

17)  kanh____bula-h- lng [524ms] nguni-njyi____wurrhwurrungu
     DEM  3-R-SEQ eat-PCust old.person

     ‘Then the old people eat it’

Figure 4.11. Pitch contour of a reattached unit (Tape1b27m59s)

Figure 4.12 shows a monosyllabic prefix with a final falling pitch contour. The prefix reattaches to an intonational phrase comprising two grammatical words excluding the prefix.

18)  bod_______ngorr__ka-h  [1035ms]  kirdikirrbu-n
     bush.fly  12pLO 3-R infect-PR

     ‘The bush flies infect us’
In Figure 4.13 the detached unit reattaches to an intonational phrase comprising three grammatical words. The grammatical word immediately preceding the detached prefix is the demonstrative ‘kanunh’.

19)  

\[ \text{wurdang}_-\text{nunh}_-\text{kanunh}_-\text{buka-h-marnu-bad}[1034\text{ms}]\text{murduk-won-inj} \]  
\[ \text{magic.powers DEM DEM 3/3-BEN-stone strong-give-PI} \]  
‘He sealed the cave in on him’
In Figure 4.14 the detached prefix forms an intonational phrase with the preceding constituent and displays a final falling pitch contour. The pronominal prefix reattaches to an intonational phrase consisting of four grammatical words excluding the prefix. The unit immediately preceding the prefix is the demonstrative ‘nunh’.

\[\text{nunh\_yala-yi-n\_\_yala-yirrbih-kun\_\_nunh\_yala-h} \ [266\text{ms}] \text{nakka-ng} \]
\[\text{DEM 1pl-say-PR 1pl-inland-from DEM 1pl-R come.from-PP} \]

‘We say we are from the inland, that is where we came from’

![Pitch contour of a reattached unit (Tape6a27m31s)](image)

In the above examples we find detached units with pitch contours that resemble those associated with a word or intonational phrase. There are no examples of a final rising pitch contour associated with a detached unit.

Detached prefixes may be both disyllabic, and monosyllabic provided that they are heavy. The number of words per intonational phrase preceding the reattached unit ranges from one to four grammatical words. The demonstratives ‘nunh’, ‘kanh’ and ‘kanunh’ are frequently found preceding a reattached unit. Where a detached unit forms an intonational phrase with just one preceding grammatical word, that word must be disyllabic, or monosyllabic provided that it is heavy.
4.3.2 Isolated units

This section will look at the occurrences of detached pronominals that do not attach to preceding words. Instead the prefix is separated from the preceding units by a pause and therefore forms its own intonational phrase.

The verbal word in Figure 4.15 was uttered hesitantly as the verb has unpleasant connotations in Dalabon and is considered insulting. Figure 4.10 shows the pitch movement of this utterance.

21) kanh [2076ms] bala-h [672ms] djer-nurru-bobm-u
    DEM 3pl-R breath-have-stink-PR
    ‘They have bad breath’

In figure 4.15 the detached pronominal prefix ‘bula-h’ forms its own intonational phrase with a single peak followed by a final falling pitch contour.

In Figure 4.16 the prefix forms its own intonational phrase with two peaks: one on each syllable, and a final falling pitch movement.

22) kenbo_kanunh_____mimal-yih [252ms] buka-h [308ms] burlkeyhwo-yan
    then DEM light-INST 3/3-R make.appear-FUT
    ‘Then he will make the light appear’
The detached prefix in Figure 4.17 forms its own intonational phrase consisting of a peak followed by a final falling pitch contour.

23) ngurra-h [387ms] djorm-iyan
   12pl/3-R catch.up.to-FUT
   ‘We two will catch up to him’

Figure 4.18 shows a prolonged pause within a word totalling almost 3 seconds in duration. The detached prefix displays a subtle falling pitch contour at the rightmost edge.
24) nunh__mahkih____da-ye [596ms] birrwoyinn-gnandung-iyan____
DEM maybe 2/3-SUB birrwoyinn-call.someone-IRR

da-ye [2963ms] wawurd-ngandung-iyan
2/3-SUB wawurd-call.someone-IRR

‘Maybe you would call him ‘brother in law’, you would call him ‘big brother’’

Figure 4.18. Pitch contour of an isolated prefix (Tape5b4m31s)

The following example illustrates the single occurrence in the data where a monosyllabic prefix detaches from the verbal word to stand isolated. The prefix is super heavy and thus conforms to the bimoraic minimum of phonological words discussed in section 2.2.3.

25) ka-h-lng [222ms] maryami-nj
3-R-SEQ get.lost-PI
‘Then he got lost’
Figure 4.19. Pitch contour of an isolated unit (Tape7b28m2s)

In Figure 4.19 the detached prefix forms its own intonational phrase characterised by a peak followed by a trough at the rightmost edge. This example furthermore illustrates the downtrend patterns of Dalabon with each peak and trough successively lowering.

The above examples illustrate the few occurrences where a detached prefix does not attach to a preceding unit. The constraint operating in these examples limits isolated units to be minimally bimoraic –that is either disyllabic, or monosyllabic and super heavy.

In all of the examples of isolated detached units in the data, the detached unit displays pitch contours typical of an intonational phrase with a final falling pitch contour. Within the data there are no occurrences of a final rising pitch contour of a detached unit. As previously noted, within a verbal word, both the prefix and the verb root + suffixes each display separate pitch contours suggesting that the pronominal prefix constitutes a separate intonational domain to the verb root + suffixes.
4.3.3 Pauses within words

Pauses within grammatical words are not limited exclusively to prefixes, but may also separate other components of the verbal word, such as incorporated nominals and adjectives. The following examples illustrate this phenomenon.

26) ka-h-Ing-kolk [1111ms] burkwon
    3-R-SEQ-water dry.out-PR
    ‘The water dries out’

Figure 4.20. Pitch contour of a grammatical word separated by pause (Tape6a8m44s)

In 26) the detached unit containing the prefix also contains the incorporated nominal ‘kolk’.

Example 27) is a somewhat unusual example, as the detached unit containing the prefix ends with the first segment of the following incorporated nominal ‘men’. As such it is the only example found in the data where a detached unit is not isomorphic to a morpheme boundary. This occurrence is a clear result of a speech error, as made evident by the speaker’s repetition of the detached unit. The pitch contour of this utterance is flat.

27) buka-h-dja-m [200ms] buka-h-dja-m [518ms] men-werrem-inj
    3/3-R-just-HES 3/3-R-just-HES mind-rub.out-PI
    ‘It just HES, it just HES cleared his mind’
In Figure 4.22 the adverbial prefix ‘yawoyh’ attaches to the pronominal prefix and forms an intonational phrase with the preceding unit. The weak pitch traces evident in the pause segment are due to background noise present in the original recording.

28) makmak_____yila-yawoyh [315ms] djorhk-iyan
not.at.all 1pl-again change-FUT
‘We will not change again’
In Figure 4.23 the incorporated nominal ‘bad’ attaches to the unit containing the pronominal prefix. This unit in turn forms an intonational phrase with the preceding unit which consists of three grammatical words excluding the prefix.

29) wurdang_____nunh__kanunh_______buka-marnu-bad [1034ms]murduk-won-inj
magic.powers DEM DEM 3/3-BEN-stone strong-give-PI
‘He sealed the cave behind him using magic powers’

30) dorrng-no-duninj_____ka-lng [487ms] dorrng-burlhm-inj
body-3Possd-really 3-SEQ body-come.out-PP
‘He edged his body out’
The following two examples show an extreme non-isomorphism of the phonological and grammatical word. The verbal word is separated by two pauses and therefore belongs to three separate intonational phrases. The grammatical word immediately preceding the detached prefix is the adverbial ‘*kardu*’.

31) nunh_kardu_ngarra-h  [482ms] yawoyh-dorrng  [509ms] marra-ngyi
   DEM maybe 1pl-R again-alive join.together-Pcust
   ‘Maybe we would come back to life again’

Figure 4.25. Pitch contour of a grammatical word separated by two pauses (Tape 7a9m26s)
In Figures 4.25 and 4.26 the detached prefix forms an intonational unit with the preceding unit, the incorporated adjectives form their own separate intonational unit as do the verb root + TAM marker. In Figure 4.25 the reattached unit forms an intonational phrase with the preceding two grammatical words ‘nunh’ and ‘kardu’. In Figure 4.26 the reattached unit forms an intonational phrase with the preceding grammatical word ‘kardu’.

The above examples illustrate that a detached unit displays a pitch contour typical of a phonological word with falling pitch at the rightmost edge. There is no final rising pitch movement associated with detached units. Reattached units illustrate an extreme case of a non-isomorphism between a grammatical word and a phonological word, as the grammatical word spans two intonational phrases. An even more extreme case of a non-isomorphism between a grammatical word and a phonological word is presented in Figures 4.25 and 4.26 as the verbal word is separated by two pauses and therefore belongs to three intonational phrases.
4.4 Detached units

The following sections will look at the units that detach from the verbal word. This phenomenon is classed into two categories based on which morphemes follow the unit containing the pronominal prefix. These are: a) detached units ending with closed final syllables, and b) detached units ending with open final syllables. In the data, the number of detached units that end in a closed syllable far outweigh those that end in an open syllable.

4.4.1 Closed syllables

The units which typically attach to a pronominal prefix to form a closed unit are the realis marker, the sequential marker or a combination of both.

33) shows the only example in the data of a detached pronominal prefix followed by just the sequential marker ‘-lng’. The detached prefix is monosyllabic, however, the syllable is closed and super heavy with the coda consisting of two segments. This example comes from a narrative describing the action of a man slowly edging his way out of a cave where the pause is used as a dramatic effect to add suspense to the narrative.

33) dorrng-no-duninj____ka-lng [487ms] dorrng-burlhm-inj
   body-3Possd-really 3-SEQ body-come.out-PP
   ‘He edged his body out’ (Tape8b3m1s)

Typically, the prefix is followed by either the realis marker, or a combination of the realis + sequential markers.

34) and 35) show the pronominal prefixes immediately followed by the realis marker.

34) kerrino____kanh__ka-h [336ms] kerri-derr [418ms] derrbka-Ø
   ground.oven DEM 3-R cooking.stone-HES put.in.animal-PR
   ‘He puts stones in the animal to cook it in the ground oven’ (Tape1a1m59s)

35) melbe_______nga-h [237ms] nahbu-ng
   mud 1/3-R step.on-PP
   ‘I stepped in the mud’ (Tape6a21m51s)
The following examples illustrate occurrences of detached units that consist of the pronominal prefix + realis marker + sequential marker.

36) buka-h-lng [224ms] kom-deyhm-inj
   3/3-R-SEQ neck-knock-PI
   ‘Then he hit him on the neck’ (Tape8b3m5s)

37) kanh__bula-h-lng [524ms] nguni-njyi
   DEM 3pl-R-SEQ eat-PCust
   ‘Then they ate’ (Tape1b27m59s)

In the following examples 38) and 39) the realis marker + ‘dja’, + sequential marker follow the pronominal prefix. In 38) the pause is of the disfluency type as illustrated by the repetition of the unit containing the pronominal prefix.

38) buka-h-dja-lng [758ms] buka-h-lng-kom-dengkohm-inj
   3/3-R-just-SEQ 3/3-R-SEQ-neck-knock-PP
   ‘Then he hit him on the neck, he just hit him on the neck’ (Tape8b3m5s)

39) kanh__ka-h-dja-lng [394ms] kurangarrk-burlhmu-ø
   DEM 3-R-just-SEQ sweat.that.runs.down.face-appear-PR
   ‘Then he just gets a sweaty face’ (Tape6a14m5s)

In the above examples there is a clear consistency regarding which prefixes attach to a pronominal prefix to form a closed final syllable. These are the sequential marker ‘-lng’, the realis marker ‘h’ or a combination of both. The majority of the detached prefixes are disyllabic, however monosyllabic prefixes may also detach from the verbal word provided they end in a closed syllable.

The following two examples illustrate the variation that exists concerning whether the benefactive marker ‘marnu’ groups with the following root, or the preceding prefix.

40) warhdu__ka-h [215ms] marnu-yenjdjung
   devil 3-R BEN-talk.together-PR
   ‘The devil, he will talk with you’ (Tape5b20m38s)
In 40) the benefactive marker ‘marnu’ attaches to the unit containing the verbal root, whereas in 41) ‘marnu’ attaches to the unit containing the pronominal prefix + subordinate marker ‘ye’ resulting in an open syllable.

Similar grouping ambiguities are found with some incorporated nominals: In 42) the second pause separates the prefix + realis marker + the incorporated nominal ‘kom’ from the verb root, whereas in 43) the pause separates the pronominal prefix + realis marker from the incorporated nominal ‘kom’ + verb root. Thus an incorporated nominal may behave in different ways by either attaching to the prefix or attaching to the verbal root.

Examples 40) to 43), then, illustrate an inconsistency in the location of the pause within a word regarding which units the benefactive marker and incorporated nominal may group with prosodically. This free variation is not observed regarding the sequential markers ‘dja’ and ‘-lng’ and the realis marker ‘h’ suggesting that these units must form a coherent unit together with the prefix, and that this unit may not be interrupted by pause.

4.4.2 Open syllables

The units which typically attach to a pronominal prefix to form an open unit are the subordinate marker ‘ye’, the benefactive marker ‘marnu’ and ‘dja’.
In 44) and 45) the pronominal prefix is followed by the subordinate marker ‘ye’ leaving the final syllable of the detached unit open.

44) nunh_mahkih_______da-ye [596ms] birrwoin-ngandung-iyan
   DEM maybe 2/3-SUB birrwoin-call.someone-IRR
   ‘Maybe you would call him ‘brother in law’’
   (Tape5b4m31s)

45) da-ye [2963ms] wawurd-ngandung-iyan
   2/3-SUB wawurd-call.someone-IRR
   ‘You would call him ‘big brother’’
   (Tape5b4m31s)

Another possibility for creating an open detached unit comes from the word ‘dja’, as illustrated in 46). This is an example of a predicate construction where the sequential marker ‘dja’ attaches to the pronominal prefix resulting in an open final syllable.

46) ka-h-dja [249ms] marlaworr-karnkarn-no
   3-R-just leaf-skinnny-3Possd
   ‘It is a skinny leaf’
   (Tape5a35m57s)

Example 41) above revealed that the benefactive marker ‘marnu’ may also attach to the unit containing the pronominal prefix resulting in a final open syllable.

Within the data, the occurrences of open final syllables preceding a pause within a word are rare. The few examples illustrated above reveal that the subordinate marker ‘ye’, the sequential marker ‘dja’ and the benefactive marker ‘marnu’ motivate the occurrences of units ending with final open syllables, which must be minimally disyllabic.
5 Discussion

5.1 Breaks

A qualitative examination of the pitch contours in the Dalabon data reveals that the constituents marked by break indices exhibit the basic ‘hat pattern’ contour, with an initial rise into the first peak and a final fall from the last peak of the intonational phrase (e.g. t’Hart, Collier & Cohen, 1990; Ladd, 1996). This pattern has been attested in Mayali (Fletcher & Evans, 2000) and the Bininj Gun-wok dialects (Bishop, 2002), as well as typologically unrelated languages such as Dutch (e.g. Cohen & t’Hart 1967; Ladd, 1996).

In the Dalabon data the pitch contour of a constituent associated with a break index 1, is typically characterised by a peak followed by a falling pitch movement at the right edge. A constituent marked by a break index 3 and 4 is characterised as comprising a sequence of break 1 constituents that may display downtrends. This type of intonational pattern has been observed in the polysynthetic Aleut language Unangan (Taff & Rozelle, 2001). Downtrend refers to a range of phonetic and phonological phenomena including declination, downstep and downdrift.

The downtrends evident in Dalabon belong to the category of declination, which refers to the declining f0 observed throughout an intonational phrase (e.g. Ladd, 1996; Vassière, 1995). Declination within an intonational phrase has been claimed as an intonational universal due to its widespread occurrence (e.g. Ladd, 1984, 1996) and has been attested in the closely related language Mayali (Fletcher & Evans, 2000), as well as typologically unrelated languages such as English and Danish (Ladd, 1996).

In the data a break index 4 shares the pitch contour patterns of a break index 3, however a break index 4 may also display a final rising pitch contour in addition to a final falling pitch contour. The occurrence of final rising pitch movement associated with a break index 4 is limited to affect utterances that are syntactically final, as attested by the lack of a final rising pitch contour associated with detached prefixes. A detached prefix preceding a pause
within a word will always display a falling pitch contour. Of the 68 detached prefixes preceding a disfluency pause only three show a final rising pitch contour. These patterns in the data suggest that a final pitch drop may signal both a complete or incomplete utterance, and that a final pitch rise exclusively signals completeness of utterance. This analysis conflicts with the intonational universal that claims pitch to drop at the end of an utterance, and to rise (or at least not to drop) at major breaks where the utterance remains incomplete (Ladd, 1996:114). These findings suggest that further cross-linguistic investigation of intonational universals is needed to account for polysynthetic languages.

As break indices were labelled on purely phonetic grounds without reference being made to the morpho-syntax of the language, nonisomorphisms between the prosodic constituents marked by break indices and the morpho-syntactic structure of the language may exist. These nonisomorphisms become evident in cases where the phonetic cues, on which the break indices were based, do not correlate with the syntactic relationship of constituents. Occurrences of detached prefixes which are associated with a break index 4, provide evidence of a nonisomorphism between prosodic and syntactic constituents as a single grammatical word may belong to up to three separate intonational phrases or utterances.

Finally it was seen that Dalabon displays intonational patterns that have been claimed to belong to the set of intonational universals (e.g. Vaissière, 1995; Ladd, 1984). Dalabon exhibits pitch reset between some intonational constituents, final lowering at the rightmost edge of some intonational phrases as well as declination spanning over some intonational phrases.

Based on the analysis of the data presented here, the assumption made is that not all levels of the prosodic hierarchy need be required in Dalabon and that Dalabon therefore has a flatter hierarchical structure. This is in line with prosodic theory which does not make the claim that all levels are required in every language (Nespor & Vogel, 1986). The prosodic constituents, above the level of the prosodic foot, for which there is evidence for in Dalabon are the phonological word, the intonational phrase and the utterance. This analysis
rejects the need for the phonological phrase in Dalabon, as there is no phonological or syntactic evidence for this domain.

However, an alternative analysis is also possible here: the prosodic constituent defined by pause may be viewed as the phonological or intonational phrase rather than the phonological word. This alternative analysis omits the domain of the phonological word rather than the phonological phrase. The latter analysis is not unacceptable, as pause has previously been used as a diagnostic for determining the prosodic status of intonational phrases (see section 2.2). These alternative possibilities present issues concerning which label should be given to a constituent delineated by pause rather than reject the original analysis presented here. Further investigation of the prosodic constituents of polysynthetic languages is needed to determine this matter.

Polysynthetic languages have the ability to string together a sequence of morphemes to create a single grammatical word, with a sometimes very elaborate meaning. A single word in a polysynthetic language may equal what synthetic languages need a larger sequence of words to express. Thus conceptual units are not necessarily expressed in phrases of word groups, but rather by means of word shapes (Mereu, 1999:3). It was therefore speculated that the number of words contained per intonational phrase would be quite small in a polysynthetic language such as Dalabon. A survey of the distribution of break indices to determine the ratio of phonological words (as indicated by a break index 1) per intonational phrase (as indicated by a break 3 or 4) confirmed this hypothesis revealing that an intonational phrase in Dalabon comprises approximately 1.9 words. These results support the findings of the closely related dialects of Bininj Gun-wok; Manyallaluk, Mayali, Kune and Kunwinjku which have a ratio of between 1.5 and 2.1 words per intonational phrase (Bishop & Fletcher, in press). For the most part an intonational phrase in Dalabon consists of just one word, though up to eight words per intonational phrase is also possible. This contrasts with studies of synthetic or analytic languages which generally contain a higher number of words per intonational phrase. A similar study of Dutch revealed that a phrase consisted of between 6.4 and 7.8 words (van Donzel & Koopmans-van Beinum, 2000).
The f0 values for both speakers revealed that the female speaker A had somewhat lower f0 values than the male speaker B. This is a surprising result as the male pitch range is typically lower than the female pitch range (e.g. Ladefoged, 2001; Pittam, 1994). As mentioned in section 3, the discourse types for the two speakers vary, which may have effects on the prosodic structure of the data. For these reasons statistical results were extracted separately for the two speakers.

Results of f0 values for the break indices 1, 3 and 4 for both speakers confirm the qualitative findings of the pitch contours of the constituents marked by break indices. A break index 1 showed a higher final f0 value than a break index 3, which in turn showed a higher final f0 value than a break index 4. The difference between these values was relatively small indicating that the final f0 values of intonational constituents marked by break indices do not vary to a great degree. Statistical results of the f0 values of the break indices revealed that the difference lay with the break index 1 and the break index 4. These results confirm the subtle declination trends evident in the data. Typically, declination occurs inside constituents marked by a break index 3 or 4. This explains the lower final f0 value of these constituents compared to a break 1 constituent. However, as the measure of declination is assumed to lie mainly with the f0 values of peaks (Ladd, 1984), as opposed to final troughs, as has been calculated here, these results may be regarded as somewhat inconclusive.

Based on the observation that constituents preceding a pause within a word never display a final rising pitch movement, and that constituents preceding a disfluency pause rarely display a final rising pitch movement, the constituents associated with a break 4 index were divided into two groups: a) utterance-final constituents, and b) non-utterance-final constituents. It was hypothesised that non-utterance-final constituents would display a lower final f0 value than utterance-final constituents as non-utterance-final constituents do not display a final rising pitch movement. This hypothesis was proven incorrect, however, as a summary of mean f0 values revealed that the non-utterance-final constituents in fact
showed a slightly higher mean than utterance-final constituents. Statistical results showed a near significant difference between the non-utterance-final and utterance-final constituents suggesting that these constituent types may have different f0 values. Further investigation of these constituent types is needed.

The higher f0 values of non-utterance-final constituents may be attributed to the declination patterns evident in the data. An utterance-final constituent signals a completeness of utterance, and as such a constituent in which declination is likely to occur. A non-utterance-final constituent, however, does not form a complete utterance entailing that declination may not have taken place to the same degree as with an utterance-final constituent.

5.2 Pause durations
The results of the pause durations were calculated from the combined results of speaker A and speaker B as an impressionistic overview of the data revealed little difference between the durations for the two speakers. Statistical results confirmed that there was no difference between the pause durations for the speakers.

As expected, statistical results revealed a clear difference between the durations for the different pause types. Standard pauses were approximately double the duration of both disfluency pauses and pauses within words. There was no significant difference between the disfluency pauses and pauses within words.

Based on the substantial difference in durations for the different pause types, the assumption may be made that the constituents preceding a pause within a word or a disfluency pause are more closely associated with the following unit than those constituents preceding a standard pause. This phenomenon may be evidence of the early stages of a historical change where pronominal prefixes go from bound to free. However, without further diachronic evidence it is impossible to determine this with any certainty.
5.3 Non-isomorphic constituents

Where a grammatical word is separated by pause, the result is a sequence of units that display pitch movements typical of an intonational phrase with a peak followed by a trough. Where the pronominal prefixes detach from the grammatical word, one of two things may occur: a) the pronominal prefix may form its own intonational phrase as defined by at least one peak, a final falling pitch movement at the rightmost edge and the presence of a notable pause to either side of the prefix, or b) a pronominal prefix may attach to a preceding unit to form an intonational phrase with that unit. The latter possibility is the most radical non-isomorphism of a grammatical and phonological word. In these circumstances the phonological word spans one grammatical word and one prefix.

Where a unit reattaches to the previous intonational phrase without an intervening pause, the intonational phrase may consist of minimally one and maximally four words. If a detached unit reattaches to just one grammatical word, that word must be minimally disyllabic, or monosyllabic provided that it is heavy. Typically the demonstratives ‘nunh’, ‘kanh’, ‘kanunh’ and the adjective ‘kardu’ precede a reattached pronominal prefix.

It was illustrated that the pronominal prefix need not be the only constituent to detach from the grammatical word, but that it is possible for other parts of the verbal word, such as incorporated nominals, to be interrupted by a pause. Typically, an incorporated nominal attaches to the unit containing the prefix, however, this is a not a requirement. It was furthermore illustrated that the verbal word may be separated by two pauses resulting in the grammatical word spanning three intonational phrases.

The analysis of Dalabon presented here demonstrates that it is possible for a grammatical word to span up to three phonological words, and that it is also possible for one intonational phrase to span all of one grammatical word + part of another grammatical word.

As discussed in section 5.1.1 an alternative analysis would be to regard the unit defined by pause as a phonological phrase or even an intonational phrase thereby avoiding some of the
issues discussed above concerning the non-isomorphism of the grammatical and the phonological word.

A detached unit displays intonation contours typical of a phonological word or intonational phrase, though never of a break index 4 with a final rising pitch contour -as discussed in sections 5.1.1 and 5.1.2 above. As the domain of the utterance is, according to Nespor & Vogel (1986), associated with a sense of finality, a true utterance-final phrase in this data is not indicated by phonetic cues alone (as a break index 4 is associated with detached units). Rather, the syntax of the language must also be taken into account. A final rising pitch contour may therefore solely be considered a cue to signal a true sense of finality, while a final falling pitch contour may signal both finality and non-finality.

5.4 Detached prefix environments

In section 4.4 the environments in which pronominal prefixes detach from the verbal word were explored in order to ascertain any phonological generalisations regarding this phenomenon. The phenomenon was classed into two categories: a) detached units ending with open final syllables, and b) detached units ending with closed final syllables. Generally detached prefixes occur together with the realis marker, the subordinate marker or the sequential markers. For the most part detached units end in closed syllables, apart from where the sequential marker ‘dja’, the subordinate marker ‘ye’ or the benefactive marker ‘marnu’ attach to the prefix.

The phonological requirements that must be met in order for a prefix to detach from the verbal word are: a) that the prefix have a bimoraic minimum (either monosyllabic and closed, or disyllabic), and b) that the remainder of the grammatical word have at least two syllables.

It was seen that certain morphemes of the verbal word, such as the realis marker or subordinate marker, always attach to the detached unit containing the pronominal prefix. Likewise the verb root is never separated from the TAM markers by a pause. This suggests
that certain sequences of morphemes must form a coherent unit together with the pronominal prefix. These units may therefore be regarded as coherence zones as they may not be separated by a pause. Other morphemes, however, such as the benefactive marker, show some variation as to which unit they attach to suggesting that these morphemes do not form coherence zones together with the pronominal prefix as they may be separated by a pause.
6 Conclusion

The phonological word in Dalabon was defined using potential pause, as the conventional phonological criteria used to define the phonological word (e.g. phonotactic generalisations) do not apply in Dalabon. In this study the constituent defined by pause was provisionally referred to as the phonological word. However this constituent may alternatively be regarded as belonging to a higher level of the prosodic hierarchy such as the phonological phrase. In order to determine which of these analyses is relevant in Dalabon further investigation of the prosodic constituents of polysynthetic languages is needed.

The non-isomorphism of the grammatical and the phonological word was investigated and the following conclusions were made:

i) The analysis of pause established, as expected, that both disfluency pauses and pauses within a word were of a significantly shorter duration than standard pauses.

ii) Where a verbal word was interrupted by a pause the sequence containing the prefix plus sequential, subordinate or realis marker, and the sequence containing the comitative, applicative, verb root, RR and TAM suffixes, is never interrupted by a pause. This suggests that within the verbal word, speakers segment smaller units independently into ‘coherence zones’, which are then assembled to form the grammatical word.

iii) Where a unit containing a pronominal prefix detaches from the verbal word the following phonological generalisations were made: a) the detached unit must be minimally bimoraic, and b) the remainder of the word must be minimally disyllabic.

iv) Where a non-isomorphism exists between the grammatical word and the phonological word one of two things may happen: a) the detached unit may stand isolated displaying its own intonation contour, b) the detached unit may attach to a preceding phonological unit. The latter of these options presents a radical non-isomorphism between the grammatical
and phonological word as a single grammatical word may belong to two or three separate intonational phrases.

v) Where reattachment of pronominal prefixes occurs the detached unit may form an intonational phrase with up to four preceding grammatical words. Typically these include the demonstratives ‘nunh’, ‘kanh’, ‘kanunh’ and the adjective ‘kardu’.

Conceivably, the phenomenon of prefix detachment may belong to an early stage of a development in Dalabon, which could eventually lead to pronominal prefixes forming their own phonological word. However, without further diachronic evidence it is impossible to state with any certainty whether or not pronominal prefix detachment is in a process of a change.
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Appendix

- Tape 1a1m59
  njel  ka-h njel  ka-h pausehes yilah-dja-bo-nj  malung
  12pl  3-R  12pl  3-R  1pl-R-just-go.around-PP  before
  
  ka-h-ru-ng  kerri  kahn pause  kerri-no  kahn
  3-R-be.burned-PR  ground.oven  DEM  ground.oven  DEM
  
  ka-h pauseww  kerri-derrk pausehes  derrbka-∅ pause  kahnkuno
  3-R  cooking.stone-HES  put.in.animal-PR  then
  
  yila-h-lng-duhybu-n
  1pl/3-R-SEQ-cook.in.ground.oven-PR

  ‘We just go around before it gets burnt in the ground oven. We put cooking stones in the animal then we cook it in the ground oven.’

- Tape 1a25m30s
  nga-h pauseww  nga-h-kom pauseww  dum-kiyan  nga-h pauseww
  1/3-R  1/3-R-throat  make.hole-FUT  1-R
  
  kom-muhm-iyan pause  wirrimah-kih  nga-h-bawo-yan
  throat-leave-FUT  CONJ-EMPH  1/3-R-leave-FUT

  ‘I will make a hole in the throat, I will leave the throat, I will leave it.’

- Tape 1a26m1s
  derrh pause  kardu  derrhno  nga-h pausehes  nga-h pausehes
tomorrow  maybe  tomorrow  1-R  1-R
  
  nga-h-n-iyan pause  kenh  nga-h-yaw-iyan
  1/3-R-see-FUT  oops  1/3-R-look.for-FUT

  ‘Maybe tomorrow I, I, I will see it, oops I mean, I will look for it.’

- Tape 1b2m48s
  bulnu  bula-h pauseww  warlkoni-nyyi pause  kardy
  3pLO  3pl-R  hide-Pcust  maybe
  
  bukorreh  nayunghyungki
  a.long.time.ago  ancestors

  ‘Maybe our ancestors hid them a long time ago.’
‘They make bone mince and then they eat it.’

‘He sealed the cave in on him using magic and then a different one just appeared.’

‘We just walk around for a long time, we will catch up to him.’
‘We call our customs ‘rules’. We follow them and we will never again change our customs. We ask just follow them forever.’

‘They live each on their own in the country. Our country will be gone. They each live on their own.’

‘Them I, them, I, I leave them.’

‘It has a skinny leaf and it is the same leaf from that type of paperbark tree.’
**Tape 5a43m35s**

bod ngorr ka-h pauseww kirdikirrbun pause muddjarrk-yih pause
bush.fly 12plO 3-R infect-PR fan-INST

muddjarrk-yih ngurra-h-bod-warhmrr-rr-un pause
fan-INST 12pl/3-R-bush.fly-fan-RR-PR

‘The bush flies infect us, we use a fan to fan ourselves.’

**Tape 5b20m38s**

warhdu ka-h pauseww marnu-yenjdju-ng kanum-ngan-kah
devil 3-R BEN-talk.together-PR ear-1Possd-LOC

ka-h-bengngayawkmibo-ng pause
3-R-whisper.in.someone’s.ear-PP

‘The devil talks to you. He whispers into one’s ear.’

**Tape 5b43m31s**

nunh mahkih da-ye pauseww birrwoin-ndung-iy-an pause
DEM maybe 2-SUB birrwoin-call.someone-IRR

da-ye pauseww wawurd-ngandung-iy-an pause o yabok-ngu
2-SUB wawurd-call.someone-IRR HES big.sister-2Possd

‘Maybe you would call him ‘brother in law’, maybe you would call him ‘big brother’, your big sister.’

**Tape 6a14m34s**

bala-h djerkurangarrk pause kanh pause bala-h pauseww
3pl-R sweat.that.runs.down.face DEM 3pl-R

djer-nurru- bobmu-ø
breath-have-stink-PR

‘They have sweat running down their faces. They have bad breath.’

**Tape 6a14m5s**

djerkurangarrkno pause djerkurangarrkno yala-h-yi-n
sweat.that.runs.down.face sweat.that.runs.down.face 1pl-R-say-PR

nunh kanunh pause ka-h-dja-ling pauseww kurangarrk-burlhmooø
DEM DEM 3-R-just-SEQ sweat.that.runs.down.face-appear-PR

‘Sweat that runs down your face, we say that sweat appears on your face.’
• Tape 6a21m51s
  nga-h-yerrkm-inj pause melbe pause mel pause melbe nga-h pauseww
  1-R-slip-PI mud mud mud 1-R

  nahbu-ng nga-h-Ing-yerrkm-inj pause dja-h-yinm-iyan pause bonj
  step.on-PP 1-R-SEQ-slip-PI 2/3-R-say-FUT finished

  ‘I slipped in the mud. I stepped on it and then I slipped. You will say that. Finished.’

• Tape 6a27m31s
  nunh pause yala-h pausehes nunh yala-yi-n yala-yirrbnih-kun
  DEM 1pl-R DEM 1pl-say-PR 1pl-inland-from

  nunh yala-h pauseww nakka-ng yirrb pause yirrbnih-walvng
  DEM 1pl-R come.from-PP inland inland-from

  yala-h-worlbb-un pause kanunh yala-ye-yi-n kahnunh pause
  1pl-R-come.from-PR DEM 1pl-SUB-say-PR DEM

  yala-h-Arnhemland-walvng pause bonj
  1pl-R-Arnhem.Land-from finished

  ‘We came from the inland. We came from the inland. We say we came from Arnhem Land. Finished.’

• Tape 6a27m51s
  ngarra-h pauseww yirrbbi-yirrbbih-kun ngorr kanunh
  12pl-R inland-REDUP-from 1plo DEM

  ngarra-h ngarra-h-worlbbun yirrbih-walung
  12pl-R 12plo-come.from-PR inland-from

  ‘We came from the inland. We came from the inland.’

• Tape 6a7m19s
  kenbo kanunh mimal-yih pause buka-h pauseww burllhkeywo-yan
  then DEM light-INST 3/3-R make.appear-FUT

  ‘Then he will make the light appear.’
‘In the wet season the dry wind blows the water in the river, then that water dries up, the water dries up.’

‘They travel in line, maybe they travel spread out.’

‘Maybe if we hadn’t (drank the moon’s urine) we would have come back to life again the way the new moon does.’

‘The rainbow bee eater just hits him, it just, it just, erases his memory.’
‘Then he got lost. He staggered looking for it. Then he got onto the track, they say.’

‘He edged his body out and they speared him right in the heart.’

‘Then he just hit him on the neck. He hit him on the neck and left his body there in the rock cave.’
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