# Word Structure in Australian Languages[*]

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In this paper we propose a new model for the analysis of complex word forms in Australian languages. We propose that complex words should be categorized in terms of their phonological patternings. We show that complex words exhibit two distinct types of phonological patternings. One type of complex word shows the same patterns as simplex words. We call morphological relations within this type of word, root-level relations (Selkirk 1982). In the other type of complex word, at least one constituent itself has the characteristics of a simplex word. We call morphological relations within this type of word, word-level relations. We demonstrate that the distinction between root-level and word-level relations has clear correlates in morphological productivity. Our model provides a straightforward account of the relationship between phonology and morphology in complex words.

## 1. Introduction

Nearly all theories of morphological analysis recognize that not all morphological relationships are of the same kind. Much modern analysis in morphological theory has been concerned with categorizing morphological relationships in terms of their phonological correlates, and their unpredictable selectional restrictions, originating with Chomsky & Halle (Chomsky & Halle, 1968: 364-371), and developed in the theory of Lexical Phonology (e.g. Allen, 1978, Borowsky, 1990, Kiparsky, 1982, Selkirk, 1982, Siegel, 1974). We argue that an analysis based on this line of argumentation is profitable for Australian languages. It allows for a unified analysis of a number of phonological phenomena, and a classification of morphological relationships in terms of independent criteria. While our model is based on the insights of Lexical Phonology, it differs from that of Lexical Phonology in some important aspects. We detail the differences in the concluding section of this paper.

In many, if not all, languages, the phonological treatment of complex words is not uniform. Very commonly, some kinds of complex words show the same patternings as simplex words. By contrast, other kinds of complex words show distinct phonological patternings from simplex words. We may consider the following examples from Ngalakgan, a language of northern Australia.[1]

(1)     *bijurdu*[2]                          [bíɟuɖu]
        'whirlwind'

(2)     a. *jung*
        'boughshade'

        b. *Ø-jung+bu+niny*                  [ɟúŋbuniɲ]
        3mS-boughshade+HIT+PC[3]
        's/he was building a boughshade'

(3)     a. *awtj*
        'house'

b. Ø-*awtj-yo+ngon*                   [àucjóŋon]
3mS-house-sleep+PR
's/he is sleeping in the house'

Trisyllabic simplex words in Ngalakgan have a single stress on their initial syllable, as in (1).[4] We can see that in (2), the complex word *jung+bu+niny* has the same stress pattern as the simplex word. By contrast, the complex word in (3) *awtj-yo+ngon*, has a distinct stress pattern.

The complex words in (2) and (3) each consist of two principal constituents: a noun and an inflected verb. The complex word in (3) consists of the Kriol (Roper River creole) loanword *awtj* (from English 'house') and the verb form *yo+ngon* 's/he is sleeping'. The meaning of the complex word is predictable given the meanings of these two principal constituents. We may observe that each of the principal constituents has a stress. We call the morphophonological relations found in complex words such as *awtj-yo+ngon* 'word-level' relations, following Selkirk (1982).

The complex word in (2), consists of the Ngalakgan noun *jung* 'boughshade' and the verb form *bu+niny* which as an independent form means 's/he was hitting [something/someone]'. The meaning of this complex word is evidently not predictable given the meanings of its constituents. There is only one stress in this word. We call morphophonological relations within this kind of complex word 'root-level' relations, again following Selkirk (1982). The phonological and semantic differences between the two types of complex words appear consistently in Ngalakgan.

Many Australian languages show this distinction within the class of complex words. We predict that the distinction between word-level and root-level relations is not randomly distributed. Rather, it has clear correlates in productivity. In words which are complex at the root-level, morphological relations will be unproductive. The particular combinations of morphemes found in these words must be lexically specified or listed, as in (2). Loanwords cannot be constituents of words which are complex at the root-level. There is for example no form \*Ø-*awtj+bu+niny* 's/he was building a house' parallel to Ø-*jung+bu+niny*.

On the other hand, complex words involving productive morphological relations will display word-level phonology. Loanwords may freely appear in words which are complex at the word-level, as in (3). It should be noted that we do not claim that the conjoint converse of our two predictions necessarily holds true. In many languages there are listed complex forms which nonetheless display word-level phonology (see example (48)).

This paper focuses on two languages, Ngalakgan and Warlpiri. There are two reasons for doing this. Firstly, there are sufficiently detailed accounts of the phonology and morphology of these two languages for the predictions of our analysis to be tested. Secondly, the two languages are historically, structurally, and geographically distant from one another. Both are members of the Australian language family, but the connection is so remote (perhaps 30 items) as to be of little relevance for any synchronic purpose. Structurally, there are many differences between them, most obviously that Ngalakgan has complex systems of both nominal and verbal prefixation, whereas Warlpiri is exclusively suffixing. The areas traditionally associated with the two languages are widely separated (600 - 800kms), and it is most unlikely that there was anything other than the most minimal and sporadic contact between speakers in pre-contact times. Consequently, there is no reason to attribute any commonalities in phonological and morphological structures between the two to diffusion.

We show that there are a number of significant phonological and morphological commonalities between the two languages. In both languages, stress placement is determined in part by reference to morphological structure, but not all morphological boundaries affect stress placement. We show that the distinction between the two sets of morphological boundaries has the same basis in both languages. We also show that this distinction is relevant to other phonological phenomena which make reference to morphological structure, such as apical neutralization, reduplication, and the distribution of long vowels in monosyllabic forms.

Many of the phenomena that we examine in Ngalakgan and Warlpiri are also found in other Australian languages. However, given the comparatively limited scope of most phonological descriptions, we are unable to adequately evaluate our analyses for most Australian languages. We hypothesize that the theoretical constructs we propose for Ngalakgan and Warlpiri will be applicable to a wide range of Australian languages, when sufficiently detailed accounts become available.

We also include some material from a third language, Warray. We do this because root-level morphological relations are confined to the verbal systems of Ngalakgan and Warlpiri. Given only the Ngalakgan and Warlpiri materials, an alternative analysis might be that there is some systematic opposition between verbal and non-verbal morphology. However, Warray has root-level relations within its nominal system. Consequently, it provides evidence that the distinction we are drawing is independent of any distinction between verbal and non-verbal morphology.


## 2. Ngalakgan

In Ngalakgan, as in most prefixing languages of northern Australia, words may have very complex internal structures. We are chiefly concerned here with the different types of relations within complex words. However, before examining these differences, it is necessary to describe the phonological patterning of simplex or unanalysable words.

Ngalakgan, like most Australian languages, has a trochaic stress system. The basic pattern in simplex words is that a primary stress is placed on the first syllable, and a secondary on every alternate syllable thereafter, subject to a proviso that final syllables do not receive a secondary stress.

(4)     *got*          [gót]           'paperbark'
        *bolo*         [bólo]          'old person'
        *bijurdu*      [bíɟuɖu]        'whirlwind'
        *gurrujardu*   [gúɾuɟàɖu]      'olive python'

Ngalakgan freely permits monosyllabic words, such as *got* 'paperbark', illustrated in (4). Monosyllabic forms are of considerable importance, as they provide a particularly clear illustration of word-level phonological patterns. One of these patterns is the distribution of vowel length. Among simplex words, long vowels are found only in monosyllables. Polysyllabic simplex forms never involve long vowels. Within the class of monosyllabic, simplex words, the distribution of vowel length is phonologically determined. Monosyllabic CV words are invariably realized with a long vowel.

(5)    *ge*    [gée]    *[gé]    'man's child'
       *je*    [ɟée]    *[ɟé]    'nose'

This long vowel realization reflects the universal requirement that lexical words are minimally bimoraic (Selkirk, 1984:343).[5] Monosyllabic CVC words with an oral coda consonant have a short vowel in phonetic realization.

(6)    *bot*    [bót]    *[bóot]    'fly'
       *rok*    [ɻók]    *[ɻóok]    'pandanus'

We assume that oral codas are moraic in CVC words, and that the bimoraic minimum requirement is thereby satisfied. In addition to CVC words with an oral coda, Ngalakgan also has CVC words with a glottal stop coda (represented orthographically by *h*). These forms involve a long vowel.

(7)    *ngoh*    [ŋóo̰ʔ]    *[ŋó̰ʔ]    'guts'

The glottal stop, unlike oral stops, is not moraic. The motivations for this are complex, and beyond the scope of the present discussion (see Baker, 1999: 252-262). Apart from the difference in moraicity, the realization patterns of the glottal stop also differ significantly from those of oral stops. As illustrated in (7), the glottal stop is partly realized as creaky voice on the preceding sonorant. This is in fact the only obligatory component of the realization of the glottal stop, and relates to its restricted distribution. In Ngalakgan, the glottal stop is found only after sonorants, and in nearly all cases at a morphological boundary (Merlan, 1983: 6-8). The glottal stop may additionally be realized by glottal closure. Glottal closure is obligatory when there is a following stop, or when there is a following pause. It is optional in other environments.

As we have already seen in (2) and (3) the patterning of complex words may or may not match to that of simplex words. However, before examining the structure of complex words, we need firstly to consider the issue of syntactic structural levels, particularly the issue of the distinction between phrases and compounds. Ngalakgan displays all the characteristics of 'free word order' that are typical of many Australian languages (Hale, 1983). There is, for example, no requirement that nominals with a common referent should appear adjacent to one another.

(8)    *góny*         *ngu-márre*      *gu-ngólkgo*
       kangaroo      1mS-spear.PP    NEUT-big
       'I speared a big kangaroo.'

Each of the words in (8) has its own primary stress. The words may appear in any order to convey the same logical interpretation. There are however, two types of constructions in Ngalakgan where the order of the constituents is fixed. One of these types corresponds well to the traditional concept of 'compound' and the other to the traditional notion of 'phrase'. We examine the 'phrase' construction later in this paper (see discussion at (31)). The compound type is illustrated in (9).

(9)    *gòny-ngólkgo*       *ngu-márre*
       kangaroo-big         1mS-spear.PP
       'I speared a big kangaroo.'

The order of the constituents in the sequence *gony-ngolkgo* is fixed as Noun-Adjective. Sequences such as *gony-ngolkgo* have a number of other distinguishing characteristics. Firstly, they have a single primary stress, which appears on the second constituent, in this case *ngolkgo*. The first constituent, in this case *gony*, bears a secondary stress. Secondly, no other morphemes can intervene between the constituents. We may compare the following examples.

(10)    *gony*        *gu-gohje*      *gu-ngolkgo*      *ngu-marre*
        kangaroo    NEUT-that      NEUT-big        1mS-spear.PP
        'I speared that big kangaroo.'

(11)    *\*gony-gohje-ngolkgo*          *ngu-marre*
        kangaroo-that-big              1mS-spear.PP
        'I speared that big kangaroo.'

(12)    *\*gony-gu-gohje*              *gu-ngolkgo*      *ngu-marre*
        kangaroo-NEUT-that            NEUT-big        1mS-spear.PP
        'I speared that big kangaroo.'

As illustrated in (10), a noun may be followed by more than one modifier, provided that all of these nominals have a primary stress. The modifiers may be independently prefixed - in (10) they bear class prefixes. However, in the construction where only the final constituent has a primary stress, then there can only be one modifier (11), and this modifier cannot be independently prefixed (12). Finally, pauses are unexceptional between the constituents of the sequence *gony gu-gohje gu-ngolkgo*. but they are ungrammatical between the constituents of *gony-ngolkgo*.

For these various reasons, we analyse constructions such as *gony-ngolkgo* as compounds rather than phrases. In Ngalakgan, the distinction between root-level and word-level relations is most evident in compounds. The clearest reflection of this distinction is in the patterns of stress placement. The patterns of stress placement found in productive compounding cannot be accounted for under the generalizations presented earlier. Compounding is highly productive in Ngalakgan, and we provide some examples following.

(13)    *jeny-yarrh*              [ɟèɲjár̺ʔ]
        fish-lots
        'lots of fish'

(14)    *rum-borno*              [ɹ̺ùmbóɳo]
        law-different
        'a different law'

(15)    *jolkgo-derh*            [ɟòlkkoɖéɹ̺ʔ]
        ground-hard
        'hard ground'

In all of these forms, the primary stress appears on a non-initial syllable. In (13) and (14), there is a stress clash, and in (13) and (15), the final syllable bears the primary stress. These stress placements follow if we posit two principles. Firstly, the

constituents of a compound have stress on the same syllable(s) when compounded as they do when they occur as independent words. Secondly, the primary stress is assigned to the final constituent in the compound.

In addition to productive compounds, shown in (13) - (15), Ngalakgan also has over one hundred lexicalized verb compounds, as in (16).

(16)     *Ø-bol+ma+nginy*                [bólmaŋiɲ]
         3mS-rub+GET+PC
         's/he was rubbing'

These lexicalized compounds consist of two constituents. There is an initial 'coverb', in this case *bol*, which provides the lexical meaning 'rub', and a final 'verb root', *ma+*, which serves as a base for tense inflection. Coverbs and verbs are the two verbal part-of-speech classes in Ngalakgan, and in most other northern languages. Verbs inflect directly for tense-aspect-mood. They can usually appear independently with a generic lexical meaning. For example, *ma+* means 'get' as an independent verb. However, a number also appear in lexicalized compounds, as in (16). When they appear in lexicalized compounds, they do not usually contribute their full independent meaning, but function as auxiliaries. Thus in (16), the verb root *ma+* does not contribute a 'get' meaning, but simply functions as an auxiliary.[6] The class of verbs is closed in all northern languages. The open verbal class is the coverb class. Coverbs are inherently non-finite. They differ from nominals in that they are inherently predicational and cannot serve as subcategorized arguments. Coverbs which appear in lexicalized compounds do not normally appear elsewhere: e.g. *bol* does not appear other than in the compound in (16).

Lexicalized coverb+verb compounds display a different stress structure to that of productive verbal compounds. We may compare the lexicalized compound in (16) with the productive verbal compound in (17).

(17)     *Ø-jeny-ma+nginy*                [ɟènmáŋiɲ]
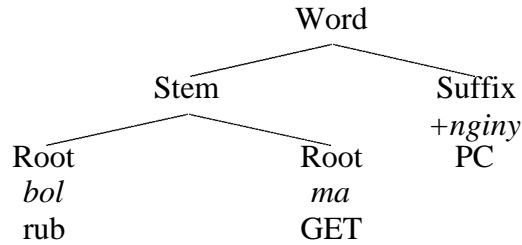         3mS-fish-get+PC
         's/he was getting fish'

We analyse *jeny-ma+nginy*, and other productive compound forms, as word-level compounds. The productive compounds are words, which are in turn composed of words.

(18)                                    Word
                            Word                    Word
                            *jeny*
                            fish                Root    Suffix
                                                *ma*    *+nginy*
                                                get     +PC

Lexicalized compounds, such as *bol+ma+nginy*, evidently cannot be analysed in this way. Their parts cannot appear as independent words, with the meanings that they have in the compound. We classify these compounds as root-level compounds, following Selkirk (1982).

(19)

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                              Word
                    ┌───────────────┴──────┐
                  Stem                   Suffix
            ┌───────┴──────┐             +nginy
          Root           Root            PC
          bol             ma
          rub            GET
```

As indicated the root + root compound constitutes a stem. Following traditional terminology, a 'stem' is a complex form which is an input to further morphological relations. Many root-level morphological relations involve stems. The role of stems is particularly evident in verbal paradigms.

(20)

|      | 'hit'            | 'get'            | 'stand'        |
|------|------------------|------------------|----------------|
| PP   | boh+bo           | meh+me           | ja+ny          |
| PC   | **bu+n**+iny     | **ma+ng**+iny    | **ja+ngan**+iny |
| PR   | **bu+n**         | mah+ma+Ø         | **ja+ngan**    |
|      |                  | ~ ma+Ø           |                |
| FUT  | **bu+n**+a       | **ma+ng**+a      | **ja+ngan**+a  |
| IRR  | **bu+n**+i       | **ma+ng**+i      | **ja+ngan**+i  |

In Ngalakgan, the Past Continuous, Future and Irrealis inflections are not added directly to the root. Rather, these inflections are added to a stem which is usually, but not always, equal to the Present tense form. The form of the stem must be lexically specified for each verb.

Another area which shows a clear contrast between root-level and word-level morphology is reduplication. We may consider the following forms from the paradigm of the 'get' verb.

(21)   *ma+Ø*              get+PR              [máa]
       *mah+ma+Ø*          RED+get+PR          [mа́ma] ~ [mа́ʔma]

(22)   *ma+nginy*          get+PC              [mа́ɲiɲ]
       *mah-ma+nginy*      ITER-get+PC         [màa̱ʔmа́ɲiɲ]

There are several types of reduplication in Ngalakgan, all of them prefixal. A reduplicated form consists of a "reduplicant" followed by a "base". The reduplicant in (22) has the characteristics of a word. It has a long vowel, and is associated with an independent stress. The reduplicated form as a whole therefore has the prosodic characteristics of a word level compound. Each part is independently stressed, and it allows stress clash. The reduplicated form in (21), by contrast, has the characteristics of a simplex word. It is a single stress domain, and the reduplicant has a short vowel.

As with root level and word level compounds, there is a contrast in the semantic interpretation of root level and word level reduplications. The word level reduplicant has an identifiable and consistent meaning - 'Iterative/Distributive' - and this kind of reduplication can be found in other word classes, such as quantifiers.

(23)   *wangginyh*          *wah-wangginyh*       [wàa̱ʔwа́ŋgiɲ]
       one                 DIST-one
       'one'               'one at a time'

The root level reduplicant has no identifiable meaning. Rather, it serves to derive particular inflectional forms in the paradigms of some verbs. As set out in (20), there are two forms of the Present tense of the 'get' verb. The unreduplicated form has a restricted distribution. As a main verb, it can only be used with a Habitual Present interpretation. The reduplicated form is the default Present tense form, conveying all Present tense meanings, including Habitual Present. In root compounds involving the 'get' verb as an auxiliary, only the unreduplicated form occurs in the Present. As also illustrated in (20), the root level reduplicant is not restricted to the Present tense. It is also found in the Past Punctual of 'get' and a number of other finite verbs, but not in other word classes.

Another area which shows a clear distinction between word-level and root-level relations is affixation. We may compare the following complex word forms.

(24)     *bo-wi*                 [bóowɨ]          *Ø-ngo+winy*      [ŋówiɲ]
         river-PERL                               3mS-eat+PP
         'along the river'                        's/he ate it.'

The root *bo* 'river' can appear as an independent word [bóo] in unaffixed usages (e.g. in citation). It maintains this long vowel regardless of the presence of following affixes. Even within a complex word form, *bo* itself is a word. The root *ngo+* does not have a long vowel, and it never appears independently. It only occurs in the form *ngo+* when followed by the Past Punctual inflection, otherwise it appears as *ngu+*.

The relationship between *bo* and the Perlative suffix *-wi* is a word-level relation, whereas that between *ngo+* and the Past Punctual suffix *+winy* is a root-level relation. Word-level affixes, like the Perlative, always attach to a stem which itself constitutes a word. Nearly all word-level affixes attach to any semantically plausible stem. In general, there are no selectional requirements on word-level affixes. By contrast, root-level affixes, like the Past Punctual form *+winy*, attach to stems which are not necessarily words, as in the case of *ngo+*. All root-level affixes display selectional restrictions. Thus *+winy* is found only in the paradigms of the 'eat' and 'cry' verbs. Other verbal paradigms show unrelated Past Punctual suffixes.

In Ngalakgan, within the class of word-level affixal relations, there are reasons to distinguish a subclass of clitics from true affixes. Complex words involving word-level affixes permit two stress patterns.

(25)     *bo-hwala*              [bòo̯ʔwála] ~ [bóo̯ʔwàla]
         river-ABL
         'from the river'

As illustrated in (25), forms involving word-level affixes may show the same stress pattern as compounds: secondary stress on the initial constituent, and primary stress on the final constituent. Alternatively, they may show primary stress on the lexical root, with a secondary on the affix (if it is capable of bearing stress).

Complex words involving clitics permit only one stress pattern, if the clitic is capable of bearing stress.

(26)    *may=borre*           [màibóre] ~ *[máibòre]
        food=theirs
        'their food'

As illustrated, only the compound stress pattern is permitted in cliticized words. Clitics are orthographically distinguished by the use of the equals sign '='. There are other differences between clitics and word-level affixes (see Baker, 1999).
        We may therefore also contrast clitics with root-level affixes, as shown in (27).

(27)    *Ø-ja+ngan+iny*     [ɟáŋaniɲ]        *je=ngini*         [ɟèeŋíni]
        3mS-stand+NP+PC                      nose-mine
        's/he was standing'                  'my nose'

As with word-level affixes, clitics are stressed independently of their hosts, while root-level affixes form a single stress domain with the root.
        The phonological characteristics we have identified in word-level affixes are also found in other kinds of elements that, at first sight, do not appear to be strictly affix-like. Ngalakgan has several productive morphological constructions which derive verbs from nouns or other verbs. One of these is the Inchoative construction, which derives predicative forms of adjectival nominals. The paradigm is illustrated in (28) with the nominal *guh* 'raw'.[7]

(28)    PP   *guh-me+ny*                 [gúu̯ʔmeɲ]
        PC   *guh-me+n+iny*              [gúu̯ʔmèniɲ] ~ [gùu̯ʔméniɲ]
        PR   *guh-me+n ~ guh-Ø*          [gúu̯ʔmen] ~ [gúu̯ʔ]
        IRR  *guh-me+n+i*                [gúu̯ʔmèni] ~ [gùu̯ʔméni]
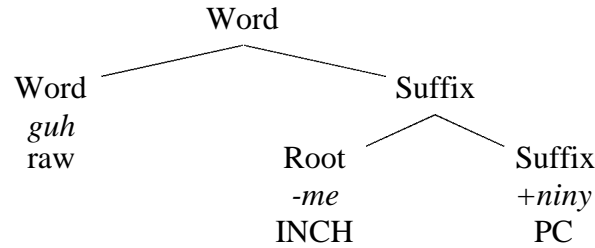        FUT  *guh-me+n+a*                [gúu̯ʔmèna] ~ [gùu̯ʔména]

The Inchoative morpheme *me+* behaves like a verb root. It has an identifiable meaning 'become', and an unpredictable conjugation of tense inflection forms.[8] However, inflected forms cannot appear independently, and consequently the *me+* conjugation is a bound conjugation. The obvious analysis of the Inchoative forms in (28) is that they consist of a compound of *guh* plus *me+*, with the meaning 'to become raw'.
        However, phonologically, these forms do not behave like compounds. If the Inchoative construction was a root-level compound, then none of the forms of *me+* should bear stress. Root-level compounds consisting of a monosyllabic root and a disyllabic inflected verbal form bear stress only on the initial root, as in (16). If the Inchoative construction was a word-level compound, then the initial constituent, *guh* in (28), should bear a secondary stress, and the final constituent, *me+*, should bear the primary.
        Rather, the Inchoative forms show the same stress patterns as forms involving word-level suffixation. As we have seen, monosyllabic word-level suffixes do not bear a stress, as in (24). Disyllabic word-level suffixes may bear either primary or secondary stress, as in (25). Consequently, we do not analyse the Inchoative construction as a compound construction, but rather as a construction involving a paradigm of word-level suffixes: *-me+ny*, *-me+n+iny*, and so forth. These word-level

suffixes themselves involve root-level morphology. We illustrate the structure of the Inchoative in (29).

(29)
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                              Word
            Word                         Suffix
            guh
            raw                Root              Suffix
                               -me               +niny
                               INCH               PC
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A similar analysis applies to the other verb derivational constructions. The largest verb class, and the only verb class which productively derives verbs based on loanwords from English (via Kriol), is morphologically a construction of this type. The paradigm of this class (called the 'thematic' class in Merlan, 1983) is presented in (30), for the coverb *yerrert* 'grow', for the Kriol loan *bayimh* 'buy', and for the coverb *leh* 'search for'.

(30)  PP      *yerrert-mi+ny*          *bayimh-mi+ny*
      PC      *yerrert-mi+riny*        *bayimh-mi+riny*
              *~ yerrert-mi+yiny*      *~ bayimh-mi+yiny*
      PR      *yerrert-Ø*              *bayimh-Ø*
      IRR     *yerrert-de*             *bayimh-me*
      FUT     *yerrert-da*             *bayimh-ma*

      PP      *leh-mi+ny*              [léȩʔmiɲ]
      PC      *leh-mi+riny*
      *~ leh-mi+yiny*                  [léȩʔmìiɲ] ~ [lèȩʔmíiɲ]⁹
      PR      *leh-Ø*                  [léȩʔ]
      IRR     *leh-ye*                 [léȩʔje]
      FUT     *leh-ya*                 [léȩʔja]

There are several major differences between this verb conjugation and all other conjugations. Firstly, this is the only paradigm which involves suppletion. There is no identifiable finite verb root form which appears throughout the paradigm of tense inflections. Secondly, every inflected form of a thematic verb is predictable from the phonological shape of the coverb stem. The Future and Irrealis forms are derived by means of gemination of the final supra-laryngeal consonant of the stem, plus the distinctive vowel associated with each tense form (Merlan, 1983: 120). In the case of coverb stems lacking a final supra-laryngeal consonant, these tense forms are realized with a glide onset determined by the place of articulation of the final vowel of the stem. The third major difference is that coverbs of this conjugation may appear in two construction types.

(31)    *burru-worrowk-mi+ny*                 [buɾuwóɾoukmiɲ]
        3aS-gallop-AUX+PP
        'they galloped'

(32)  *worrowk*    *burru-mi+ny*          [wórouk buɾumìɲ]
      gallop       3aS-AUX+PP
      'they galloped'

In addition to the standard construction illustrated in (31), there is an alternative phrasal construction illustrated in (32). This alternative is commonly used in monologic discourse. It is only attested in the Past Punctual, and is only possible with change-of-state or event-type coverbs.[10] The phrasal construction differs from compound constructions in several respects. Firstly, a pause is standardly placed between the coverb stem and the second constituent. However, in faster speech, the two may be cliticized together. Secondly, primary stress can only be placed on the first constituent. Thirdly, the coverb may appear alone, at the end of an intonational group, to signal the termination of a durative sequence of events. The second constituent can never appear alone. Finally, the first constituent of the phrasal construction may itself be compounded:

(33)  *guh-warrh*   *burr-mi+ny*          [gùu̯ʔwáɾʔ buɾmìɲ]
      dead-throw    3aS-AUX+PP
      'they threw it away dead'[11]

As previously discussed Ngalakgan, like most Australian languages, has free word order. However, in the phrasal coverb construction, the order of constituents may not be changed. The constituents cannot be separated by other material. The two constituents must appear under a single intonation contour.

The phrasal construction provides particularly clear evidence for the status of thematic coverbs as words. In addition, there are no subminimal thematic coverbs. The thematic conjugation shows the same stress patternings as the Inchoative. We therefore regard the thematic verb forms, such as *-mi+ny*, as word-level affixes. Like the Inchoative inflections, some of the thematic inflectional suffixes are in turn complex at the root-level.

The other major construction of this type is the Causative. Causatives are derived with the finite verb root *ga+*, which independently means 'take'. Only coverbs from the thematic conjugation can productively be derived with the Causative.

(34)  *gu-dulh-mi+ny*
      NEUT-alight-AUX+PP
      'it [fire] flared up'

(35)  *ngu-gu-dulh-ga+nginy*       [ŋuguɖúl̪ʔgàɳiɲ] ~ [ŋuguɖùl̪ʔgáɳiɲ]
      1mS-NEUT-alight-CAUS+PP
      'I set it alight'

Like the Inchoative and Thematic conjugations, the Causative inflections have the prosodic properties of word-level suffixes, which are again complex at the root-level.

Ngalakgan possesses a large number of prefixes in both the nominal and verbal domains. Without exception, all prefixation is at the word-level.

(36)     *ngurrurn-mu-ne*          [ŋuruŋmuɲée]
         12aO-VEG-burn.PR
         'it [sun: VEG class] burns us (incl.)'

As with word-level suffixes, word-level prefixes do not contribute to the bimoraic minimum of a word-level stem. Hence, *ne* must have a long vowel when prefixed.


## 2.1 The apical contrast in Ngalakgan

Ngalakgan, like many Australian languages, contrasts two series of apicals: alveolars and retroflexes.

(37)     *ba**rn**arrh*          [baɳarʔ]     *wa**n**arr*          [wanar]
         'marble tree'                       'rock ring-tailed possum'

The principal phonetic cue for the contrast is that the retroflexes have an [ɻ] offglide on a preceding vowel, whereas the alveolars do not. In positions where there is no preceding vowel, including word-initial position, there is no contrast. After a pause, or following any consonant-final morpheme, word-initial apicals are alveolar.[12]

(38)     *Ø-**n**e+ny*          [néɲ]
         3aS-burn+PP
         's/he burned it'

(39)     *ngu-birditj-**n**e+ny*          [ŋubìɖicnéɲ]
         1mS-nearly-burn+PP
         'I nearly burnt it.'

However, following any vowel-final morpheme (regardless of vowel quality), morpheme-initial apicals are retroflex.

(40)     a. *ngu-gu-**n**e+ny*                    [ŋuguɳéɲ]
         1mS-NEUT-burn+PP
         'I burned it [NEUT class]'

         b. *yi-gi-**n**e+ny*                    [jigiɳéɲ]
         12mS-NEUT-burn+PP
         'We (incl.du.) burned it [NEUT class]'

Word-level affixes and clitics show the same pattern as word-level stems: retroflex following a vowel, alveolar elsewhere.

(41)     *gu-got=**n**owi*          [gugòtnówi]
         NEUT-money=his
         'his money'

(42)   *gu-je=**n**owi*              [guɟèeŋówi]
       NEUT-nose=his
       'his nose'

      Root-level morphemes, on the other hand, exhibit an apical contrast, just as is found word-internally.[13]

(43)   *Ø-ngu+**n**iny*             [ŋúniɲ]
       3mS-eat+PC
       's/he was eating'

(44)   *Ø-wi+na+**n**iny*           [wíŋaniɲ]
       3mS-forget+SEE+PC
       's/he was always forgetting'

      In these two examples, the PC affix *+niny* contrasts with the root-initial retroflex in the auxiliary *na+*.


## 3. Warlpiri

In this section we will show that Warlpiri has both root-level and word-level relations within complex words. Both of the phonological correlates of this distinction are shared with Ngalakgan: vowel length and stress. Warlpiri differs from Ngalakgan in that vowel length is contrastive (Nash, 1986: 65). However, as in Ngalakgan, there is a requirement that words are minimally bimoraic. The only monosyllabic forms which can appear as independent words must have a long vowel (45) (Laughren p.c.), including loans from English, e.g. (46) (Nash p.c.).

(45)   a.   *jaa*   'mouth'
       b.   *raa*   'open(ing)'
       c.   *rii*   'to smoothe'

(46)        *wuu*   'war'

      Warlpiri is similar to Ngalakgan in that words often have complex internal structures. It is also similar to Ngalakgan in that stress placement is one of the central diagnostics for the differential analysis of morphological relations. The metrical system of Warlpiri classes generally with that of Ngalakgan. The primary source on Warlpiri metrical structure is Nash (1986), which provides the following generalizations on the metrical system.

(47)   a. The system is trochaic.
       b. Most polymoraic morphemes constitute independent metrical domains.
       c. The first polymoraic morpheme in a word has the primary stress on its initial syllable. All subsequent polymoraic morphemes have a secondary stress on their initial syllable.
       d. Within a metrical domain, a secondary stress is placed on every alternate syllable after the primary, subject to the proviso that the final syllable may not receive a secondary stress.[14]

The (b) generalization in (47) is evidently unsatisfactory, as it is qualified. The exceptions to this generalization are found in the verbal system. In Warlpiri, as in Ngalakgan, there are two major verbal part-of-speech categories. There is an open class of coverbs, known as preverbs in the literature on Warlpiri, and there is a closed class of directly inflecting verbs. As in Ngalakgan, the majority of verbal predicate meanings are conveyed by compounds of a preverb and a verb. The internal semantic relations within these compounds vary considerably, but they all display word-level phonological relations.[15]

(48)     *tíirl-pàrdi+mi*                    *párdi+mi*
         split/separate-EMERGE+NP     emerge/arise+NP
         'split(s), separate(s)'            'emerge(s), arise(s)'

The compound verb 'split apart, separate' consists of a preverb *tiirl* and a verb form *pardi*, which means 'emerge, arise' when it appears independently. The verb does not carry its independent meaning into the compound, and as such, it functions as an auxiliary verb. Nonetheless, the verb form *pardi+mi* is still phonologically a word. It maintains an independently assigned stress, and it satisfies the bimoraic word minimum. For the same reasons, the preverb *tiirl* is also a word, even though it cannot appear independently.

There is no word-level/root-level contrast in Warlpiri compounds. All compounds have word-level phonological correlates, as in (48). Nor is there a contrast in reduplicated words. Reduplicated words have the same phonological structure as compound words. The only contrast between word and root -level relations which has consistent phonological correlates is found within the affixal paradigms of verbs in Warlpiri. We therefore turn to an examination of the Warlpiri verbal system.

In descriptions of Warlpiri, verbs are organized into five conjugations (Nash, 1986:40-41, 242-246). Each conjugation has its own paradigm of tense, aspect and mood suffixation.

| (49) | Conj1 'speak' | Conj 2 'rub' | Conj 3 'see' | Conj 4 'eat' | Conj 5 'go' |
|---|---|---|---|---|---|
| Past | *wángka+ja* | *mápa+rnu* | *nyá+ngu* | *ngá+rnu* | *yá+nu* |
| Non+Past | *wángka+Ø ~ wángka+mi* | *mápa+rni* | *nyá+nyi* | *ngá+rni* | *yá+ni* |
| Presentative | *wángka+nya* | *mápa+rnìnya* | *nyá+nganya* | *ngá+rninya* | *yá+nanya* |
| Imperative | *wángka+ya* | *mápa+ka* | *nyá+ngka* | *ngá+nja* | *yá+nta* |
| Future | *wángka+ji* | *mápa+ku* | *nyá+ngku* | *ngá+lku* | *yá+nku* |

All of the inflected verbal forms in (49) are words. We analyse the internal relations within these words as root-level relations. The choice of suffixal paradigms is evidently lexically determined. There is no requirement that verb roots should meet the bimoraic word minimum. We may contrast the Presentative tense form of 'see' in (50) with the word-level compound structure in (48).

(50)     *nyá+nganya*                    **nyáa-ngànya*

If relations within these verbal words were word-level relations, then we would expect, in forms involving a monosyllabic root and a disyllabic suffix, that both the root and the suffix would bear a stress. The fact that *nya* cannot occur as an

independent word is not relevant. Other monosyllabic bound word-level forms must have long vowels, e.g. *tiirl* in (48).

Conjugations 1 and 2 are the major conjugations, each having approximately 50 members. All the roots in Conjugation 2 are disyllabic.[16] Roots in Conjugation 1 may be disyllabic, trisyllabic, or quadrisyllabic. Conjugations 3, 4, and 5 are minor conjugations. Conjugation 4 contains only the monomoraic root *nga+* 'consume, eat', illustrated in (49). Conjugation 5 contains three monomoraic verb roots. Conjugation 3 contains four monomoraic verb roots. For speakers of Eastern Warlpiri, it also contains two trisyllabic verb roots.[17]

Roots from conjugations 2-5 never appear as independent words, always requiring a substantive suffix. Roots from conjugation 1 can appear as words. However, when they do so, they do not convey a generic root-level meaning such as 'speak'. Rather, when they appear as words, they function as one of the allomorphs of the Non-Past, with meanings such as 'speak(s), will speak'.

This difference between conjugation 1 and the other conjugations is of significance in the analysis of verbal forms involving more complex affixation. However, before considering these more complex verbal forms, we need firstly to describe the general patterning of word-level suffixation in Warlpiri. We illustrate this with examples involving suffixation to nominals, as there are no significant root-level nominal morphological relations in Warlpiri. Complex nominals involving a simplex stem and a single monomoraic suffix pattern as if they were unanalysable.

(51)     *wíta-ngka*                         *wátiyà-rla*
         small-LOC                         tree-LOC

These forms have secondary stress placement in accordance with generalization (d) in (47). In complex nominals, involving sequences of two monomoraic morphemes, the first receives a secondary stress.

(52)     *wíta-ngkà-rlu*
         small-LOC-ERG

(53)     *wátiya-rlà-rlu*
         tree-LOC-ERG

In nominals involving a sequence of three monomoraic suffixes, there is a secondary stress on the first morpheme (Nash p.c.).

(54)     *wátiya-rlà-rlu-ju*
         tree-LOC-ERG-TOP

These patterns of secondary stress placement are most easily accounted for if sequences of word-level monomoraic suffixes are taken to constitute an independent metrical domain.[18]

In addition to word-level suffixes, Warlpiri also has enclitics.[19] Enclitics differ from suffixes in two ways. Firstly, enclitics do not attach to a particular word. Rather, they attach to a particular position in the utterance: second or initial position, depending upon a range of factors. Secondly, in a sequence of monomoraic enclitics, the first bears a secondary stress.

(55)     *ngápa-ngkù-ju=ju*
         water-ERG-TOP=1SG.SUBJ

(56)     *ngápa-ngka=jù=lu*
         water-LOC=1SG.SUBJ=3PL.OBJ


    The literature on Warlpiri analyses enclitics as belonging to a constituent called AUX, which is distinct from all other constituent types in Warlpiri. As discussed in Simpson & Withgott (1986), the AUX consists solely of grammatical morphemes. There is no lexical head morpheme in the AUX. The internal relations within the AUX are subject to unpredictable selectional restrictions. We analyse the AUX as a word-level constituent with internal root-level relations. However, as AUX is a grammatical and not a lexical word, it is not subject to the bimoraic minimum, following Selkirk (1984:343). Consequently, monosyllabic tokens of AUX do not show long vowels.

    Having set out the patterns of word-level relations involving suffixes and enclitics, we may now return to consider the interaction between word-level and root-level relations within more complex verbal forms. We begin with the infinitive form in (57).

(57)     *mápa+rni-njà-rla*              *\*mápa+rnì-nja-rla*
         rub+NP-INF-LOC
         'to rub, for rubbing'


    The secondary stress placement in this infinitive form does not match the placement found in forms involving a sequence of three word-level suffixes. As stated in Nash (1986: 112-115), the Infinitive *-nja* attracts stress, when it is followed by other monomoraic morphemes. Under other analyses, this must simply be stipulated. We will show that under our analysis, distinguishing root-level from word-level relations, the secondary stress placement in (57) follows without additional stipulation.

    As illustrated, the sequence *mapa+rni*, which appears in (57), is the Non-Past form of this verb, being a Conjugation 2 verb. However, there is evidently no Non-Past meaning to be assigned to this form in (57). The form in (57) is non-finite. As in Ngalakgan (20), the combination of the root and the Non-Past suffix, *mapa+rni*, constitutes a stem for further inflection. The choice of the Non-Past as a stem is not random. Warlpiri speakers use the Non-Past form of the verb as the citation form, as for example in discussions of the meanings of verbs in the Warlpiri dictionary (Laughren and al., 1998).

    The Non-Past is a word-level stem, with internal root-level complexity. In Warlpiri, the Non-Past forms of verbs from Conjugations 2, 4, and 5 serve as stems for the Infinitive.

| (58) | Conjugation 2 | Conjugation 4 | Conjugation 5 |
|------|---------------|---------------|---------------|
| Non-Past | *mápa+rni* | *ngá+rni* | *yá+ni* |
| | rub+NP | eat+NP | go+NP |
| | 'rub, will rub' | 'eat, will eat' | 'go, will go' |
| | | | |
| INF-LOC | *mápa+rni-njà-rla* | *ngá+rni-njà-rla* | *yá+ni-njà-rla* |
| | rub+NP-INF-LOC | eat+NP-INF-LOC | go+NP-INF-LOC |
| | 'to rub, for rubbing' | 'to eat, for eating' | 'to go, for going' |

We analyse the relation between the Non-Past stem and the Infinitive as a word-level relation in the form in (57). Unlike the tense suffixes, the form of the Infinitive is not selectionally restricted. Unlike the Non-Past stem-forming affix, it has a consistent interpretation.

Given the word-level relationship between the stem and Infinitive, other consequences follow automatically. The stress in Infinitive forms is like that of affixed nominals: *mápa+rni-njà-rla* has the same stress as *wátiya-rlà-rlu* because *mapa+rni* is a word-level stem like *watiya*, and *-nja* is a word-level suffix like *-rla*.

By contrast, the Infinitive form of Conjugation 3 verbs does not involve word level relations.

(59)     Non-Past                  Infinitive
         *pí+nyi*                  *pí+nja-rla*
         hit+NP                    hit+INF-LOC
         'hit, will hit'           'to hit, for hitting'

As shown in (59), the Infinitive of Conjugation 3 verbs attaches directly to the root, *pi+* in this case. We regard it as a root-level relation in this case. The form of the stem must be specified. There is no vowel-lengthening in the root (*\*píi-njà-rla*). Evidently *pi+* does not count as a word in this form. As we will see later in this section, Conjugation 3 displays distinctive irregularities in other verbal structures.

The form of the Infinitive for Conjugation 1 verbs has two possible analyses.

(60)     Non-Past                              Infinitive
         *wírnpirli+Ø ~ wírnpirlì+mi*          *wírnpirli+Ø-njà-rla*
         whistle+NP                            whistle+NP-INF-LOC
         'whistle, will whistle'               'to whistle, for whistling'

For Conjugation 1 verbs, the stem for the Infinitive could be analysed as either the zero-suffixed Non-Past form or as simply the root. We adopt the first hypothesis because it allows for a uniform analysis of the Infinitive in Warlpiri. With the exception of the irregular Conjugation 3, the Infinitive is a word-level suffix which attaches to a word-level stem: the Non-Past form of the verb.

This necessarily raises the question of why there is no alternative form for the Infinitive, using the substantive Non-Past affix in the stem, e.g. *\*wirnpirli+mi-nja*. We regard this as being due to the operation of a distinct principle, called 'Uniform Exponence' in e.g. Flemming (1995) and Kenstowicz (1996). Uniform Exponence requires that sets of morphologically related words be as segmentally and prosodically similar as possible. The idea behind this principle is that paradigms should exhibit maximal transparency of structure. In order to achieve this aim, ideally the root-level and word-level stems should be segmentally identical.

It is the interaction of these two requirements - that the stem be a word, and that it be maximally similar to the root - which together determine that *wirnpirli+mi* is an unsatisfactory stem for the Infinitive. In the other conjugations, the root form cannot appear as a word-level form. It is therefore unavailable as a word-level stem. Consequently a substantively inflected form must be chosen as the stem. In the case of Conjugation 1, the word level form *wirnpirli+Ø* 'whistle(s), will whistle' is segmentally identical to the root *wirnpirli* 'whistle'. Consequently, it will always be preferred to the other Non-Past allomorph *wirnpirli+mi* 'whistle(s), will whistle', which, as a word-level stem, is segmentally distinct from the root.

The Non-Past does not serve as a stem for the Infinitive only. It also serves as a stem for two other verbal constructions: the Perfective Inceptive (hereafter known simply as the Inceptive) and the Imperfective Inceptive.[20] However, there are additional complications with these two constructions. Both sets of constructions are finite, and bear conjugationally determined tense/aspect/mood suffixes. The paradigm for the Inceptive is given in (61).

(61) Past     *-nju+nu*
   Non-Past   *-nji+ni*
   Imperative  *-nji+ngka ~ -nji+nta*
   Future    *-nji+nki*

The internal relations within this paradigm are evidently root-level relations, as they are in the verbal paradigms. The Inceptive paradigm however differs somewhat from the verbal paradigms in (49). Unlike the verbal paradigms, the Inceptive lacks a Presentative category, and does not permit Infinitive forms.[21]

In Inceptive forms from conjugations other than conjugation 3, the Inceptive root *-nji* bears a secondary stress, regardless of the length of the preceding stem.

(62)     Non-Past       Inceptive
Conjugation 1 *wírnpirli+Ø ~ wírnpirlì+mi* *wírnpirli+Ø-njì+ni*
      whistle+NP      whistle+NP-INCEP+NP
      'whistle(s), will whistle'  'goes and whistles'

Conjugation 2 *mápa+rni*     *mápa+rni-njì+ni*
      rub+NP       rub+NP-INCEP+NP
      'rub(s), will rub'    'goes and rubs'

Conjugation 4 *ngá+rni*      *ngá+rni-njì+ni*
      eat+NP       eat+NP-INCEP+NP
      'eat(s), will eat'    'goes and eats'

Conjugation 5 *má+ni*      *má+ni-njì+ni*
      get+NP       get+NP-INCEP+NP
      'get(s), will get'    'goes and gets'

We analyse the stress placement in these forms as reflecting two factors. Firstly, the fact that there is a word-level boundary between the Non-Past stem and the Inceptive. Secondly, that the Inceptive paradigm itself constitutes a word-level metrical domain. The Inceptive, then, forms a paradigm of lexicalised word-level suffixes which attach to the Non-Past stem of verbs, itself lexicalised.[22] As such, the

Inceptive suffixes are stressed in the same way as word-level suffixes of the same size.

(63)   [[*mápa+rni*]-*njì+ni*]
       rub+NP-INCEP+NP
       'goes and rubs'

       [[*yáparla*]-*ngùrlu*]
       grandmother-ELAT
       'from (my) granny'

The Warlpiri Infinitive and Inceptive contrast in this respect with Ngalakgan inflectional forms such as the Irrealis (20). Despite the fact that both are built on the Non-Past stem, the Irrealis in Ngalakgan is a root-level formation. The form of the Irrealis (and other forms based on the Non-Past) is unpredictable, and must be specified for each verb. Therefore, Ngalakgan Irrealis forms have the same stress as monomorphemic words of the same length. The Ngalakgan constructions which are analogous in structure to the Warlpiri Inceptive are the Inchoative (28), Thematic (30) and Causative constructions (35). All involve paradigms of word-level suffixes, which are themselves internally complex at the root-level.

The four monomoraic verb roots in Conjugation 3, those found in all dialects, have two allomorphs of the Inceptive. The Inceptive forms of the 'hit' verb are illustrated in (64).

(64)   Past          *pí+nja+nu*          *pí+nja+nu-njù+nu*
       Non-Past      *pí+nja+ni*          *pí+nja+ni-njì+ni*
       Imperative    *pí+nja+nka*         *pí+nja+ni-njì+ngka/+nta*
       Future        *pí+nja+nku*         *pí+nja+ni-njì+nki*

One of the Inceptive constructions in Conjugation 3 differs from those found in other conjugations. In the form which is *pi+nja+ni* in the Non-Past, the Inceptive affix is *+nja*, rather than the *-nji* found elsewhere. In addition, it attaches directly to the root. The relation between the root and Inceptive suffix in this case is a root-level relation, for the same reasons that the Infinitive is a root-level suffix in Conjugation 3. In both the Inceptive and Infinitive, the inflected form is stressed as an unanalysable word.

The other Inceptive construction is largely regular. The Inceptive paradigm is that found with all other verbs, and as with other verbs, it attaches to a stem which is a word. However its stem is the Non-Past form of the irregular Inceptive, rather than the Non-Past form of the verb itself.

The Imperfective Inceptive construction is a further word-level suffixal paradigm which takes the Non-Past stem. The paradigm for the Imperfective Inceptive is given in (65).

(65)   Past          *-nji+na+nu*
       Non-Past      *-nji+na+ni*
       Imperative    *-nji+na+nta*
       Future        *-nji+na+nku*

As illustrated, the Imperfective Inceptive consists of the Inceptive suffix –*nji* followed by an Imperfective suffix +*na*. There are no irregular Imperfective Inceptive forms. The Imperfective Inceptives of conjugation 3 verbs are based on the regular Inceptive allomorphs found in this conjugation (64).

The Imperfective Inceptive suffixes are stressed on their initial syllable.

(66)     *wírnpirli+Ø-njì+na+ni*          *mápa+rni-njì+na+ni*
         whistle+NP-INCEP+IMPF+NP         rub+NP-INCEP+IMPF+NP
         'is going around whistling'      'is going around rubbing'
         (Conjugation 1)                  (Conjugation 2)

There are two possible morphological analyses of the Imperfective Inceptive forms, such as those in (66).

(67)     a. [[*mapa+rni*]-*nji+na+ni*]          b. [[*mapa+rni+nji*]-*na+ni*]
            rub+NP-INCEP+IMPF+NP                   rub+NP+INCEP-IMPF+NP

Under the (a) analysis, the Non-Past is the stem, whereas under the (b) analysis, the Non-Past + Inceptive is the stem. We analyse the Non-Past, rather than the Inceptive, as the stem for the Imperfective Inceptive. There are two reasons for this. Firstly, the stress placement indicates the word boundary falls between the Non-Past stem and the following suffixes. If the Imperfective suffix +*na* attached to a stem ending in the Inceptive suffix -*nji*, we would expect that the forms in (66) would be stressed as (68).

(68)     *[[*mápa+rnì+nji*]-*nà+ni*]
          rub+NP+INCEP-IMPF+NP
          'is going around rubbing'

Secondly, the form *mapa+rni+nji* is not a possible verbal word form.[23] The Inceptive suffix must be followed by a substantive TAM suffix. A combination of the Non-Past and the Inceptive cannot therefore serve as a word-level stem. Given that the Imperfective Inceptive is a word-level suffix it must attach to a word-level stem.

The Imperfective Inceptive paradigm has a particularly complex internal structure. We illustrate its structure below.

(69)                                          Word

Word-level                  Stem                            Suffix

Root-level           Root          Suffix          Stem              Suffix
                     *mapa*        +*rni*                            +*ni*
                     rub            NP        Root       Root         NP
                                              -*nji*     +*na*
                                              INCEP      IMPF
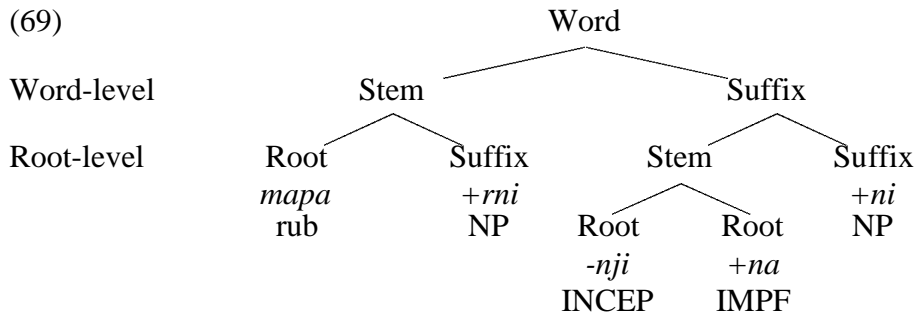
As shown the Inceptive and Imperfective combine to form an exceptional root-level compound stem. The TAM suffixes are then attached to this stem.

## 3.1 Alternative analyses of stress in Warlpiri

The metrical systems of most Australian languages are very similar in most important respects. In nearly all languages the basic foot type is the trochee, and morphological boundaries are an important determiner of the placement of feet. The stress patterns of Australian languages, including Warlpiri, have been the subject of several phonological analyses, beginning with (Poser, 1986), in the Lexical Phonological framework, and continuing, in the Optimality Theory framework, with Crowhurst (1994), Kager (1996), and Pensalfini (2000), among others.

All of these analyses recognise that the central issue is the alignment of feet with morphological boundaries. They propose various mechanisms for ensuring the correct alignments. However, none of them recognise the distinction in morphological relations which we have shown is crucial to stress placement in Warlpiri and Ngalakgan. Consequently, they are all unable to account for complex words which involve both root-level and word-level morphology. We repeat here example (57) which is a form of this type.

(70)     *mápa+rni-njà-rla*
         rub+NP-INF-LOC
         'to rub, for rubbing'

The analyses specifically examining Warlpiri (Kager, 1996; Pensalfini, 2000) both predict the following stress pattern for the word in (70).

(71)     **mápa-rnì-nja-rla*
         rub-NP-INF-LOC
         'to rub, for rubbing'

Kager (1996:16) proposes that the following constraints determine the metrical structures of Warlpiri, in the ranking (a)>(e):

(72)     a. Feet are disyllabic trochees
         b. Align the left edge of every Prosodic Word to the left edge of a foot
         c. Align the left edge of every morpheme to the left edge of a Prosodic Word
         d. Every syllable belongs to a foot
         e. Align the left edge of every foot to the left edge of a Prosodic Word

Constraints (a-d) do not decide between forms like those in (70) and (71). However the second foot in *(mápa)-(rnì-nja)-rla* is closer to the left edge of the prosodic word than in *(mápa)+rni-(njà-rla)* (where parentheses indicate feet). Hence, the unattested form (71) satisfies constraint (e) better and consequently *mápa-rnì-nja-rla* is preferred to *mápa+rni-njà-rla*.

Pensalfini (2000:6) proposes an alternative set of constraints for Warlpiri, in the ranking (a)>(e):[24]

(73)     a. Two unstressed syllables must be separated by a foot boundary
         b. A nucleus from a root does not appear in the same foot as a nucleus from another morpheme
         c. A nucleus from an affix does not appear in the same foot as a nucleus from another morpheme

        d. A syllable is parsed to a foot
        e. The left edge of every foot coincides with the left edge of a prosodic word

Again, because the second foot in *mápa-rnì-nja-rla* is closer to the left edge of the prosodic word than in *mápa+rni-njà-rla*, *mápa-rnì-nja-rla* is preferred (by constraint e) to *mápa+rni-njà-rla*.

      Any analysis which involves a requirement to align feet to all morphological boundaries, or conversely all morphological boundaries to feet, will similarly fail because of the lack of interaction between root-level boundaries and metrical structure in Australian languages.


## 4. The Oblique suffix in Warray

Warray is a congener of Ngalakgan, though not a particularly close congener. Its morphological structures are very similar to those of Ngalakgan. The distribution of root-level vs word-level relations is also very similar to that in Ngalakgan. Root-level morphology is mostly found within the verbal system, and nominal morphology is largely word-level.

      However there is one nominal suffix, the Oblique, which is a root-level suffix. The forms of the Oblique suffix are largely identical to the forms of the Dative suffix. They both show the following regular allomorphy.

(74)     *+Cu*         After a stop-final stem. The C is a copy of the stem-final stop.
         *+wu*        After a vowel-final stem
         *+u*          Elsewhere

      The Oblique suffix undoubtedly derives historically from a specialization of certain Dative functions. However, synchronically, the Dative and the Oblique must be distinguished from one another for semantic, morphological and phonological reasons. The Dative is a standard case suffix, which conveys a typical set of Dative meanings 'for, to, of (etc)'. It makes a compositional contribution to the meaning of complex words. It attaches to regular nominal stems, which by themselves satisfy the requirements for word-hood in Warray. The Dative has no effect on metrical structure, other than the effects found generally with nominal suffixation.

      By contrast, the Oblique conveys the general meaning 'negatively/excessively characterized by'. This is not a meaning that the Dative conveys. The structural form and precise interpretation of the Oblique vary unpredictably depending upon the semantic domain of the stem. The Oblique generally attaches to regular nominal stems, but in some cases the form of the Oblique stem must be lexically specified. The Oblique stem does not necessarily satisfy the requirements for word-hood. The metrical structure of forms involving the Oblique always differs from that of forms involving nominal suffixes.

      The characteristics of words in Warray are largely the same as those in Ngalakgan and Warlpiri. Words must satisfy the bimoraic minimum, and consequently CV and CVC word forms are realized with a long vowel.

(75)     *ge*     [gée]     *[gé]     'paperbark'
        *wik*    [wíik]    *[wík]     'water'

These long vowel realizations are maintained in most suffixed forms.

(76)    *ge-lik*          [géelik]        *[gélik]
        paperbark-LOC


        *wik-lik*         [wíiklik]       *[wíklik]
         water-LOC

        We assume that this follows from the requirement that the stem for a word-level suffix, such as *-lik* 'Locative', must constitute a word. The stress system is trochaic, and all polysyllabic morphemes constitute independent stress domains. There is a stress on the initial syllable of every metrical domain. Unanalysable forms greater than 3 syllables in length bear a stress on the penultimate syllable in that domain.[25] Monosyllabic suffixes do not affect the stress pattern of the stem.

(77)    *márriyámbun*                 *játbula-wu*              *\*játbulá-wu*
        stone axe                     old man-DAT

        The patterns illustrated in (76) and (77) hold of all nominal suffixation save for the Oblique.
        In addition to its nominal suffixation system, Warray also has a nominal prefixation system marking four classes.

(78)    *a-*          Some human males, some others
        *al-*         Human females, some others
        *an-*         Part entities
        *Ø-*          All other nominals

        Prefixes receive variable treatment in the metrical system. Most commonly prefixes pattern as if they combined to form a metrical domain with the root they attach to. Consequently, they generally bear a stress, as they are initial in the domain. Less commonly, prefixes do not combine with the root to form a metrical domain. Consequently, they do not bear a stress unless the stem to which they attach is monosyllabic, in which case the prefix does bear stress.
        The Oblique is most commonly attested with roots referring to inalienable body parts, which bear the Class III prefix *an-*. This prefix always combines with the root to form a metrical domain in unsuffixed forms, and in forms bearing suffixes other than the Oblique.

(79)    *an-bart*         [ánbaʈ]         *an-bart-du*          [ánbaʈʈu]
        III-knee                          III-knee-DAT
        'knee'                            'for the knee'

        However, the Oblique forms of body part roots do not necessarily take the Class III prefix, but may take either of the Class I or II prefixes, depending on the sex of the referent.

(80)    *al-bart+du*      [albáʈʈu]
        II-knee+OBL
        'knee-y'

(81)  *an-ngarndi*   [ánŋaɳɖi]   *a-ngarndi+wu*   [aŋáɳɖiwu]
      III-throat                  I-throat+OBL
      'throat'                    'throaty'

The Oblique form in (80) was used as a 'misfortune nickname' for a woman with bad knees. The Oblique form in (81) was used as a misfortune nickname for a man with a whispery voice. As shown, the body part root + Oblique suffix constitutes an independent stress domain, with the prefix being excluded. The Oblique forms of body part roots may also take the Class III prefix.

(82)  *an-ngar*    [ánŋaɻ]    *an-ngar+u*    [anŋáɻu]
      III-fur                III-fur+OBL
      'fur, body hair'       'furry'

(83)  *an-gibe*    [ángibe]    *an-gibe-wu*    [ángibewu]
      III-back                III-back-DAT
      'back'                  'for the back'

      *an-gibarr+u*   [ángibáɾu]
      III-back+OBL
      'hump-backed [back-y]'

The Oblique form in (83) has an irregular stem *gibarr*, which is found only with the Oblique.
      The Oblique is also attested with food terms, in the meaning 'greedy for, excessively desirous of'.

(84)  *bok*    [bóok]    *bok-gu*    [bóokku]
      honey            honey-DAT
      'honey'          'for honey'

      *a-bokgu-bok+gu*    [abókkubókku]
      I-INTENS-honey+OBL
      'greedy for sweet things'

As shown in (84), this construction differs from the construction type found with body part nominals. In the construction found with food terms, there is obligatory reduplication. As also shown in (84), the root in the Dative form of 'honey' has a long vowel, whereas the root in the Oblique form of 'honey' has a short vowel. The root in the Dative form satisfies the requirements for word-hood, whereas the root in the Oblique does not.
      The third construction type involving the Oblique is a compound structure. It appears to have been used with terms relating to the physical environment.

(85)  *matj*    [máac]    *a-gu-matj+ju*    [agúumáccu]
      wind            I-lots-wind+OBL
      'wind'          'windy'

This compound has a fixed first constituent *gu*, which is not independently attested. As with the Oblique form in (84), it may be noted that the Oblique stem in (85) does not satisfy minimum word requirements, having only a short vowel.

The contrasts between the Oblique suffix and other nominal suffixes in Warray are the same root-level vs word-level contrasts that we have seen in Ngalakgan and Warlpiri. The patterning of the Warray Oblique suffix establishes that the root-level vs word-level contrast cannot be equated with the verbal vs non-verbal contrast.[26]

## 5. Conclusion

We have shown that there are a number of characteristics which distinguish word-level and root-level relations in Ngalakgan and Warlpiri. Word-level affixes, clitics and reduplicants attach to stems which are words, for all prosodic and semantic purposes. Word-level stems must be minimally bimoraic. Word-level stems constitute a stress domain independent of other morphemes. All productive morphological relations in Ngalakgan and Warlpiri are at the word level.

By contrast, root-level affixes and reduplicants attach to stems which are not necessarily words. Root-level stems do not necessarily constitute independent stress domains, nor need they be minimally bimoraic. The combination of root-level morphemes is always subject to arbitrary selectional restrictions.

In Ngalakgan, the distribution of apicals is also sensitive to the distinction between word-level and root-level relations. Forms which are root-complex behave like monomorphemic forms in terms of apical neutralization and stress. This is true generally of words which are complex at the root-level: they pattern as if they had no internal morphological structure.

In both languages, recognizing a distinction between word-level and root-level constructions allows us to explain the appearance of morphemes which make no consistent semantic contribution to the meaning of the word. In both Warlpiri and Ngalakgan, the NonPast serves as a stem for other inflections. Forms based on the NonPast however do not necessarily have any NonPast meaning (for instance, the Infinitive in Warlpiri or the Past Imperfective in Ngalakgan).

We follow Borowsky (1990; 1993) in allowing for just two 'levels' or types of morphological relations: Root and Word. Furthermore, we predict that for those phonological patterns where two types of complex words are distinguished, that root-complex forms will show the same patterns as simplex forms; whereas in word-complex forms, at least one constituent of the word will itself have the characteristics of a simplex word. In this respect, we differ from versions of Lexical Phonology which allow for, in principle, *n*-ary levels of morphological structure within complex words. For example, Kiparsky (1982) proposes three levels for English, while Mohanan (1986:28, 68) allows for four in both English and Malayalam.

Pinker (1999) suggests that a two-level morphological system reflects something deeper about the human language capacity. He suggests that there is a basic distinction between what he refers to as 'words and rules' (following other authors such as Aronoff, 1976; Jackendoff, 1975; Lieber, 1980)

> Language uses two kinds of rules: true rules that speakers generalize freely, and lexical redundancy rules that merely capture patterns of similarity among words stored in memory…Irregular inflection depends on memorized words or forms similar to them, but

regular inflection can apply to any word, regardless of whether the word is readily retrievable from memory. (Pinker, 1999: 118-119)

To some degree, this separation between unproductively and productively-derived forms is implicit in the Lexical Phonology literature. For example, Kiparsky summarises the model thus:

> the first level comprises the affixes which have usually been associated with the + boundary. ... This level includes derivational suffixes such as *-al, -ous, -ity, -th,* and inflectional suffixes such as those in *kept, met, hidden, children, addenda, indices, foci* as well as "ablaut", "umlaut", and other stem changing morphology as in *teethe, bleed, bathe, teeth, lice.* To the second level we assign # boundary ("secondary") derivation and compounding. Such derivational suffixes as *-hood, -ness, -er, -ism, -ist* belong here. The third level takes care of the remaining "regular" inflection (*leaped, pleated, books, conundrums, indexes, crocuses,* etc.). (Kiparsky, 1982:5)

Evidently, the morphemes listed as level 1 are unproductive whereas those listed as levels 2 and 3 are productive. However, this is not a theoretical claim of the model. A similar connection is also implicit in Borowsky's model of English phonology (1990). She states that 'All rules which are marked for a particular [morphological] domain of application apply at level 1 only (1990:13). Given that unproductive patterns are necessarily restricted in their domain of application, they will be confined to level 1. However, again no theoretical claim is made concerning relations between productivity and phonological patterns.

Mohanan notes that the association between productivity and phonological patterns is worthy of further investigation:

> The reader will have noticed that affixation at stratum 1 is by and large less productive than affixation at stratum 2. This is also correlates with the fact that there are fewer lexical exceptions, and fewer cases of semantic opacity in words derived at stratum 2. Thus, *dis-* and *-ment* are affixed at stratum 2 in a productive fashion, creating semantically transparent results, while the same affixes attach unproductively at stratum 1, creating semantically opaque forms. ... My guess is that if a language has two strata of affixation or two strata of compounding, the earlier stratum would be the one that yields more opaque forms. If this is a correct observation, it merits further study. (Mohanan, 1986:57)

Our model proposes that Mohanan's observation is correct and that it should be formally incorporated into theories of morphophonological structures. As the first step in incorporating this observation, we need to examine the notion of productivity. There are at least two ways in which complex words may be said to be 'unproductive'. One of these is exemplified by forms like the Warlpiri verb form *tiirl-pardi+mi* 'split(s)'. In this case, the non-productivity resides in the fact that the meaning of the complex word is non-compositional. Non-compositional forms are necessarily 'listed' in the permanent lexicon of speakers.

The other way in which complex words can be said to be unproductive is exemplified by forms such as the Warlpiri verb form *wangka+ja* 'speak+Past'. In this case, the non-productivity is not a function of the semantics. Rather, it is because the affix *+ja* which appears to encode the meaning 'Past' has a morphologically-restricted distribution. It only appears with the morphologically-specified class of conjugation 1 verbs. Conjugation 2 verbs take a different affix: *+rnu*. The distribution of these two Past tense suffixes is not predictable from any general phonological or semantic principles.

Allowing for these two subtypes of 'productivity', we propose the following kinds of conjunctions between productivity and phonological patterns.

Root-level and unproductive
Word-level and unproductive
Word-level and productive
*Root-level and productive

In other words, all complex words involving root-level relations are characterised by non-compositionality and/or arbitrary morphological restrictions on the range of roots and/or affixes. The model specifically excludes the possibility that productive morphology could display root-level phonology.

The distinction between word-level and root-level morphological relations accounts for the phonological and morphological patterns found in complex words in Ngalakgan and Warlpiri in a straightforward and elegant fashion. Models which treat all internal morphological relations as being of the same type cannot account for the same range of patterns without stipulation.

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[1] Except where indicated, Ngalakgan data is drawn from Baker's fieldnotes and (Baker, 1999), and Warray data from Harvey's fieldnotes.

[2] The standard orthography for Ngalakgan and Warray is as follows: short and mostly voiced stops are written *b, d, rd, j, g* syllable-initially, and *p, t, rt, tj, k* syllable-finally and represent bilabial, apico-alveolar, apico-postalveolar, lamino-postalveolar and velar articulations respectively. Accordingly *pb, td, rtd, tjj, kg* represent geminate (long, tense, and voiceless) versions of the same stops. Glottal stop is written *h*. Nasals corresponding to the stops are *m, n, rn, ny, ng*, laterals *l, rl*, tap *rr* and labio-velar, retroflex and palatal approximants *w, r, y*. The digraph *nk* represents an alveolar nasal followed by a velar stop [ŋg], whereas the homorganic cluster [ŋg] is written *ngg*. Clusters are simplified orthographically: *nj* represents the homorganic cluster [ɲɟ]. The standard orthography for Warlpiri is identical except that only the following stop symbols are used: *p, t, rt, j, k*. The digraph *rd* represents a retroflex tap.

[3] The following abbreviations are used in this paper:

Boundary symbols: + ('root-level'), - ('word-level'), = ('clitic'). We use glosses such as 'HIT' in upper case to gloss finite verbs used as auxiliaries.

1, 12, 2, 3: 1st, 1st inclusive, 2nd, 3rd person; a: augmented number (≈ plural); ABL: ablative; ALL: allative; AUX: auxiliary, finite verb stem; CAUS: causative; DAT: dative; DIST: distributed; ELAT: elative; ERG: ergative; F/FUT: future; I: noun class I; II: noun class II; III: noun class III; IMPF: imperfective; INCEP: inceptive; INCH: inchoative; INF: infinitive; INTENS: intensified; IRR: irrealis; ITER: iterative; LOC: locative; m: minimal number (≈ singular); NEUT: neuter noun class; NP: non-past; O/OBJ: object; OBL: oblique; PC: past continuous; PL: plural; POT: potential; PP: past punctual, present perfect; PR: present; RED: reduplication; S/SUBJ: subject (that is, Agent of a transitive or Subject of an intransitive verb); SG: singular; TOP: topic; VEG: vegetable noun class.

[4] There are some additional complications, as syllable weight does affect stress placement. However, these variations are not of relevance to the distinction between word-level and root-level morphology, and we do not consider them here. For a discussion of the nature and effects of syllable weight in Ngalakgan, see Baker (1999).

[5] We mean 'universal' in the Optimality Theory sense, whereby constraints can be observably true of a large number of languages, but nevertheless violated in some languages by higher-ranked constraints.

[6] It is for this reason that its gloss appears in capitals.

[7] In fact, the interpretations of the inflected forms of adjectival nominals are not the same as the corresponding verb forms, as Merlan (1983: 57) shows. The difference between the meanings of tense inflections in verbs and tense inflections in adjectival nominals is not relevant to the argument here however.

[8] Unlike the English inchoative 'become', the *me-* inchoative cannot attach to phrases. It attaches only to words.

[9] There are additional complicating factors involved in the realization of the PC form *–miriny* (here we differ from Merlan (1983), who records this form as *–meriny*). This form is consistently realized by all speakers as [məɻɪɲ], with an initial schwa vowel. As is common cross-linguistically, schwa vowel realizations cannot bear stress in Ngalakgan.

[10] Merlan (1983:130) records three examples of this construction. One is with the thematic auxiliary *mi+*, the other two are with the Causative auxiliary *ga+*, discussed immediately following.

[11] The root *guh* is polysemous meaning both 'raw' and 'dead'.

[12] Unless the preceding consonant is [+apical], in which case the morpheme-initial apical assimilates totally to the place of the preceding apical.

[13] The practical orthography for Ngalakgan does not represent the apical contrast following morpheme boundaries. Apicals in this environment are represented simply as *d, n, l*. Ordinarily in this orthography, morpheme breaks in inflected finite verbs are not indicated. Hence the difference in realisation of *+niny* and *+na*.

[14] Generalization (d) is not explicitly presented in Nash (1986), but the examples given of domain-internal secondary stresses accord with this principle.

[15] Nash (1986: 140) states that preverbs such as *tiirl* have a short vowel (hence, *tirl*). However, more recent sources (Laughren and al., 1998) list all monosyllabic preverbs with a long vowel. We follow the more recent source here.

[16] Nash (1986: 245) lists *wuurlparra-rni* and *yilyiwirrpi-rni* as roots in Conjugation 2. However, both of these verbs were shown to be compounds by subsequent research (Laughren and al., 1998) - *wuurl-parra-rni* and *yilyi-wirrpi-rni*.

[17] Nash (1986: 246) lists four trisyllabic verbs in Conjugation 3. However, two of these verbs *palyarri-nyi* 'rub' and *jurdurri-nyi* 'cover up' were shown by subsequent research (Laughren and al., 1998) to be compounds: *palyarr-yi-nyi*, and *jurdurr-yi-nyi*.

[18] There is some disagreement about the consistency of secondary stress placement in word forms with the structures in (54)-(56), involving sequences of monosyllabic suffixes or clitics. Laughren (p.c.) states that there is variation in both the presence and placement of secondary stress in these forms.

[19] Nash (1986: 55-64) uses the term 'enclitic' to refer to any affix which is not restricted to a single syntactic word class. However, the bound morphemes falling into the class of 'enclitic' as Nash defines it display widely varying behaviours. We reserve the term 'enclitic' for those bound morphemes which appear in second position in the intonational phrase. These morphemes display phonological behaviour distinguishing them from the other morphemes that Nash describes as enclitics.

[20] The verbal forms we refer to as the Imperfective Inceptive (following Laughren) are referred to as the 'progressive' in Nash (1986).

[21] Nash (1986: 113) lists Infinitive forms of Inceptives, e.g. *paka-rni-nji-ni-nja*. However, Laughren (p.c.) states that such forms are unattested in natural data, although some speakers will accept them when such forms are proffered.

[22] By 'lexicalised' we mean 'having unproductive, root-level relations'.

[23] There is a word-form *maparninji*. However, this is a deverbal nominal form meaning 'very rubbed'. The nominalizing *–nji* suffix in this structure is unrelated to the Inceptive *–nji* suffix.

[24] Pensalfini does not explicitly address the ranking of constraint (e) in the analysis of Warlpiri. We extrapolate from his analyses that it is ranked lowest in this hierarchy.

[25] There is a distinction between primary and secondary stress in Warray. However, while the distribution of stresses within a word is clear, their hierarchical organization into primary vs secondary requires further research. As the distinction is not relevant to any of the points under discussion here, we do not differentially mark primary vs secondary.

[26] A reviewer suggests that the difference between the Oblique and the Dative suffixes in Warray might be captured with a contrast between derivational and inflectional affixation. However, as in Ngalakgan affixes traditionally regarded as 'inflectional' such as the verbal tense-aspect-mood suffixes in Warray display the same phonological behaviour as the Oblique.