Aspects of intonation and prosody

in Bininj Gun-wok:

an autosegmental-metrical analysis

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Submitted in total fulfilment of the requirements
of the degree of Doctor of Philosophy

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The University of Melbourne

August 2002
Abstract

This dissertation presents a qualitative and quantitative analysis of aspects of the intonation and prosody of an Australian polysynthetic language, Bininj Gun-wok (BGW; also referred to as Mayali). The theoretical framework is autosegmental-metrical phonology, as adapted to the description of intonation by Pierrehumbert (1980), Bruce (1977) and others. The analysis focuses principally on two dialects, Kuninjku and Manyallaluk Mayali (MM), with some reference to the Kunwinjku, Kune, Gun-Djeihmi and Kundedjnjenghmi dialects.

One of the principal motivations for analysing intonation and prosody in BGW is to provide input to the developing field of intonational-prosodic typology, from the perspective of a language which is typologically interesting on at least two counts: its position in the Australian language family, and its polysynthetic character. This dissertation provides numerous auditory as well as visual records relating to the contents of the analysis. The provision of auditory records is an innovation intended to improve the accountability of the phonetic analysis and to facilitate typological comparison.

The content of the chapters is as follows. In Chapter 1, I review the literature on intonation and prosody in polysynthetic languages (§1.2) and in Australian languages (§1.3), and highlight findings relating to possible parameters in intonational-prosodic typology (§1.3). I outline the grammatical and segmental phonological structures of BGW (§1.4) and describe the autosegmental-metrical theoretical framework (§1.5). I then discuss the ToBI model of intonation and prosody transcription (§1.6), and present the Bininj Gun-wok system of transcription (§1.7).

In Chapter 2, I discuss the corpus of texts analysed in the preparation of the dissertation (§2.2). An overview of the basic intonational contours is presented (§2.3–2.5) and the prosodic constituent hierarchy of BGW is described (§2.6), drawing on illustrations from across the six dialects. The intonational grammar is described in §2.7.

In Chapter 3, I review the literature on metrical structure in stress accent languages (§3.2), and analyse the organisation and derivation of metrical structure in the
Kuninjku and Manyallaluk Mayali dialects (§3.3–3.4), and its relationship to the assignment of intonational pitch accents within the phonological word.

Chapter 4 presents an experiment to determine whether the acoustic correlates of metrical structure observed in other stress accent languages are also found in BGW (Kuninjku dialect).

In Chapter 5, I apply a process of elimination to determine whether variations in the phonetic alignment of high pitch accent targets are potentially related to distinct phonological categories, or are conditioned by phonetic or prosodic context (§5.2–5.4). I analyse patterns of transitional high F0 (§5.5), and discuss their implications for models of phonetic implementation in BGW.

In Chapter 6, I present arguments for a previously undescribed level of prosodic constituency in BGW, the phonological phrase, and show how it is differentiated from other levels of prosodic constituency.

Chapter 7 describes the lexical content of phonological phrases (§7.3), patterns of ‘prosodic integration’ of accented words in phonological phrases, and the distinct phrasing patterns of unaccented words (§7.4).

Chapter 8 concludes the dissertation, providing an overview of the principal findings and their implications (§8.1), and discussing directions for future research (§8.2).
Declaration

This is to certify that

• the thesis comprises only my original work towards the PhD except where indicated in the Preface;
• due acknowledgement has been made in the text to all other material used;
• the thesis is less than 100,000 words in length, exclusive of tables, maps, bibliographies and appendices.

Signed

JUDITH BISHOP

12th August, 2002
Preface

The section on the Bininj Gun-wok ToBI transcription system (BGW-ToBI) presented in Chapter 1, section 1.7 of this dissertation, draws on a chapter jointly written with Dr Janet Fletcher, which is to be published in Prosodic Models and Transcription: Towards Prosodic Typology, edited by S.-A. Jun. Oxford: Oxford University Press. The material on the tone tier was written together with Dr Fletcher, after comparing our analyses of different dialects of BGW (my work on the Kuninjku, Kunwinjku, Manyallaluk Mayali and Kune dialects, and Dr Fletcher’s analyses of the Gun-Djeihmi and Kundednjenghmi dialects). The material relating to the break index tier is entirely my own.
Acknowledgements

My thanks and gratitude,

first of all, to my Binjin Gun-wok language teachers and consultants during my five months’ fieldwork in Manyallaluk: Mary-Ann Kalamuka, †Hilda Dooley, Lily Dooley, Kirsten Dooley, Peter Bolgi and Anna Bolgi, †Reggie Miller and Margaret Miller, for their generosity in sharing their language, their patience, for laughing together, and for sharing stories and insights which have remained with me.

Also to those who were personally kind and generous in various ways during my time at Manyallaluk: Mavis Jumbiri (for helping with the transcription of the story Ngarrarla and Wurruyung, and for giving me the tiny throat bones of wurruung, which are the baby in the story), Carol Pamkal and Jinel Pamkal (for being like a younger sister during the five months), and my garrart, Judy Dalywater.

To Murray Garde, my sincere and heartfelt thanks for generously sharing his recordings of Kuninjku speakers, which became so integral to this analysis.

To my two supervisors, Nick Evans and Janet Fletcher, whose advice – stern when it was needed! – has been so valuable in shaping the final product, and whose encouragement has helped me through the most difficult phases.

Finally, my love and gratitude,

To my parents, Ted and Beryl; and to past and present friends in the lab, especially Bruce, Nick, and Dana (for showing it’s possible to finish!): for their warmth, encouragement, good humour and passionate conversations about downstep and peak alignment, blond babies and pink carpeting, and for sharing the odd cup of tea…

to Karin, for her care and wonderful philosophical conversations, and Drew, for sharing and re-inspiring my pursuit of poetic ones,

and to Simon, for his constant affection and amazing generosity, for keeping me well and making me smile, and for never losing sight of what is most important in living.
# Table of Contents

## CHAPTER 1

### INTRODUCTION

1.1 **AIMS OF THE DISSERTATION** ........................................................................................................................................ 1
1.1.1 *The project of intonational-prosodic typology* ........................................................................................................ 3
1.1.2 *Definitions of key terms* ..................................................................................................................................... 4

1.2 **INTONATION AND PROSODY IN POLYSYNTHETIC LANGUAGES** ......................................................................................... 5
1.2.1 *Previous studies of polysynthetic languages* ......................................................................................................... 5
1.2.2 *Polysynthetic languages and the role of intonation and prosody in relation to information structure* ........................................................................................................ 6

1.3 **PREVIOUS STUDIES OF INTONATION AND PROSODY IN AUSTRALIAN LANGUAGES** .............................................................. 8
1.3.1 *Wik-Mungkan* ............................................................................................................................................... 9
1.3.2 *Dyirbal* .................................................................................................................................................. 12
1.3.3 *Kayardild* ........................................................................................................................................ 13
1.3.4 *Iwaidja* ............................................................................................................................................. 13
1.3.5 *Overview of intonational-prosodic typology in Australian languages* ................................................................. 15
1.3.5.1 Postlexical vs lexical uses of tone .................................................................................................................. 15
1.3.5.2 Delimitative uses of tone .......................................................................................................................... 15
1.3.5.3 Culminative and prominence-lending uses of tone ..................................................................................... 16
1.3.5.4 Lexical and grammatical conditioning of intonation .................................................................................. 16
1.3.5.5 Relationships between intonation, prosody and information structure ...................................................... 17
1.3.5.6 Contrastive modifications of the tonal space (pitch register) ..................................................................... 17

1.4 **FEATURES OF BGW RELEVANT TO INTONATION AND PROSODY** ......................................................................................... 18
1.4.1 *Syllable structure and syllable weight* .............................................................................................................. 18
1.4.2 *Morphosyntactic structure* ............................................................................................................................ 18
1.4.3 *Word order* ............................................................................................................................................... 21
1.4.4 *Previous descriptions of stress, accent and intonational phrasing* ............................................................................ 22

1.5 **THE AUTOSEGMENTAL-METRICAL FRAMEWORK** ........................................................................................................... 23
1.5.1 *The components of an autosegmental-metrical analysis* ...................................................................................... 23
1.5.2 *The application of AM theory and the phonetic implementation model to BGW* ....................................................... 25
1.5.3 *The phonetic description of tonal phenomena* ................................................................................................. 27

1.6 **CHOICE AND DEVELOPMENT OF A TRANSCRIPTION SYSTEM** .......................................................................................... 29
1.6.1 *ToBI* ..................................................................................................................................................... 30
1.6.1.1 The original development of ToBI ................................................................................................................ 30
1.6.1.2 *ToBI and tonal phonology* .................................................................................................................... 31
1.6.1.3 *ToBI and prosodic phonology* ................................................................................................................ 32
1.6.1.4 *ToBI annotation and the phonological status of transcriptions* .................................................................. 33
1.6.1.5 *Annotation of pitch range in ToBI transcription systems* ........................................................................... 36
1.6.2 *Comparison with INTSINT* .................................................................................................................................. 37
CHAPTER 2

OVERVIEW OF BININJ GUN-WOK INTONATION AND PROSODY

2.1 INTRODUCTION AND OVERVIEW .................................................................................................................. 59

2.2 OVERVIEW OF THE CORPUS ........................................................................................................................ 59

2.2.1 Texts and transcriptions ......................................................................................................................... 59

2.2.2 Sociolinguistic variation in the corpus .................................................................................................... 62

2.2.3 Genre and the choice of text materials .................................................................................................. 63

2.3 DECLARATIVE INTONATION ........................................................................................................................ 64

2.3.1 Hat pattern contours ............................................................................................................................ 64

2.3.2 Simple falling contours ......................................................................................................................... 65

2.3.3 ‘Terraced’ downstepping and upstepping contours ............................................................................... 67

2.3.4 Contours with a low-rising boundary .................................................................................................... 67

2.3.5 High level contours .............................................................................................................................. 73

2.3.6 Stylised high sustained contours ........................................................................................................ 82

2.4 INTERROGATIVE INTONATION .................................................................................................................. 96

2.5 IMPERATIVE INTONATION ........................................................................................................................ 99
2.6 THE PROSODIC CONSTITUENT HIERARCHY IN BINNI GUN-WOK ............................................................... 100
2.6.1 The prosodic constituent hierarchy and correlates of the levels of constituency ..................... 100
2.6.2 Other cues to prosodic constituent levels .................................................................................... 104
2.6.2.1 Pause duration, pause perception and the relationship between pause and prosodic boundary strength .......................................................................................................................................................................................... 104
2.7 AN INTONATIONAL GRAMMAR OF BGW ............................................................................................ 106
2.8 CONCLUSION ............................................................................................................................................ 109

CHAPTER 3

METRICAL STRUCTURE AND INTONATIONAL PITCH ACCENT

3.1 INTRODUCTION AND OVERVIEW ........................................................................................................ 111
3.2 METRICAL STRUCTURE IN STRESS ACCENT LANGUAGES .................................................................. 113
3.2.1 Definition of metrical structure ........................................................................................................ 113
3.2.2 Definitions of stress accent languages ............................................................................................. 113
3.2.3 Definitions of pitch accent ............................................................................................................. 115
3.3 METRICAL CONSTITUENCY, MORPHOLOGICAL CONSTITUENCY AND THE BRACKETED GRID ............... 115
3.3.1 Metrical and morphological constituency ....................................................................................... 115
3.3.2 Types, tokens and the metrical grid: a note on terms and methodology ....................................... 118
3.4 METRICAL AND MORPHOLOGICAL STRUCTURE IN BGW ............................................................ 119
3.4.1 Alignment of unbounded feet and morphemes ............................................................................. 119
3.4.2 Foot construction in monomorphemic words ............................................................................... 122
3.4.3 Alternative morphological and metrical analyses of morphemes .................................................. 127
3.4.4 The cohering morphemes ............................................................................................................. 128
3.5 METRICAL STRUCTURE AND INTONATIONAL PITCH ACCENT ASSIGNMENT .................................... 129
3.5.1 Pre- and Post-Accent Metrical Head Deletion in BGW ................................................................. 131
3.5.2 Adjacent accents in polymorphemic words ................................................................................... 135
3.5.2.1 Tolerance of ‘prominence clash’ in BGW ......................................................................................... 135
3.5.2.2 Differences in rhythmic prominence between single and double accented words .................. 136
3.5.3 Non-adjacent accents in polymorphemic words ............................................................................. 145
3.5.3.1 Phonetic realisation of contours with non-adjacent accents ...................................................... 145
3.5.4 Variable accent assignment to metrically strong syllables within the word: minimal and near-minimal pairs .................................................................................................. 151
3.5.5 General unaccentability of word-final syllables ............................................................................ 155
3.6 AN EFFECT OF SYLLABLE WEIGHT ON THE LOCATION OF ACCENT ..................................................... 163
3.7 THE SPECIAL STATUS OF THE PENULTIMATE SYLLABLE IN MANYALLALUK MAYALI .................... 163
3.8 PITCH ACCENT ‘SHIFT’ ATTRIBUTABLE TO CHANGES IN METRICAL STRUCTURE (ADDITION OF METRICAL ELEMENTS) ............................................................................................................ 169
3.9 MORPHEME-FINAL EMPHASIS ........................................................................................................ 172
3.10 VERB-FINAL ACCENT IN WH-QUESTIONS AND IMPERATIVE CONSTRUCTIONS IN MANYALLALUK MAYALI .................................................................................................................. 183
CHAPTER 4

ACOUSTIC CORRELATES OF METRICAL STRENGTH

4.1 INTRODUCTION AND OVERVIEW ................................................................. 213
4.2 ACOUSTIC CORRELATES OF METRICAL STRENGTH IN STRESS ACCENT LANGUAGES ...................... 213
4.3 ACOUSTIC CORRELATES OF METRICAL STRENGTH IN AUSTRALIAN STRESS ACCENT LANGUAGES ...... 215
4.3.1 Duration ................................................................................................. 215
4.3.2 Intensity (RMS amplitude) ................................................................. 217
4.3.3 Vowel quality ........................................................ ..................................... 218
4.3.4 Vowel elision ...................................................................................... 219
4.4 AIMS OF THE STUDY .............................................................................. 220
4.5 METHOD AND CORPUS ......................................................................... 221
4.5.1 Duration ................................................................................................. 221
4.5.2 Peak RMS amplitude ........................................................................... 224
4.5.3 Vowel quality ...................................................................................... 225
4.6 RESULTS .................................................................................................. 226
4.6.1 Duration ................................................................................................. 226
4.6.1.1 Effect of accent on duration ......................................................... 226
4.6.1.2 Timing effects within the word: duration of accented syllables in word-initial position in short and longer words ................................................................. 228
4.6.1.3 Phrase-position effects on accented and unaccented antepenultimate and penultimate syllables ...... 229
4.6.1.4 Phrase position effects on unaccented word-final syllables ............ 231
4.6.2 Peak RMS amplitude ........................................................................... 232
4.6.3 Vowel quality in accented and unaccented vowels ......................... 233
4.6.4 Other segmental correlates of metrical weakness ............................... 235
4.6.4.1 Vowel elision and syllable reduction in metricaly weak syllables ...... 235
4.6.4.2 Glide deletion in metrically weak syllables ..................................... 238
4.7 INCONSISTENCY OF SYNTAGMATIC VARIATION IN DURATION, INTENSITY AND F0 .................. 240
4.8 DISCUSSION ............................................................................................. 242
4.8.1 Duration ........................................................................................................................................ 242
4.8.2 RMS amplitude .............................................................................................................................. 246
4.9 Conclusion............................................................................................................................................. 246

CHAPTER 5

PHONOLOGICAL PITCH ACCENT TYPE AND PHONETIC REALISATION:
The H* Pitch Accent, Its Alignment, and Transitions From Accents

5.1 INTRODUCTION AND OVERVIEW ........................................................................................................... 247
5.2 ACCENT TYPE AND PEAK ALIGNMENT WITH THE METRICALLY STRONG SYLLABLE .................................. 249
5.3 PEAK ALIGNMENT IN RELATION TO PERIODS OF HIGH SPECTRAL CHANGE ....................................... 251
5.4 ‘EARLY’ AND ‘LATE’ PEAK ALIGNMENT IN KUNINJUKU ........................................................................ 255
5.4.1 Phonetic patterns of peak alignment in Kuninjku ........................................................................... 255
5.4.2 Literature on factors conditioning peak alignment ............................................................................. 256
5.4.2.1 Segmental effects on peak delay: Stressed syllable/vowel duration ......................................................... 256
5.4.2.2 Right-hand prosodic context .................................................................................................................. 259
5.4.2.3 Left-hand prosodic context .................................................................................................................... 261
5.4.2.4 Contour type and peak alignment: The hat pattern ................................................................................ 264
5.4.2.5 Late peak alignment and the interpretation of emphasis ........................................................................ 266
5.4.2.6 Measures of peak delay used in the literature ......................................................................................... 267
5.4.3 AIMS OF THE STUDY .......................................................................................................................... 271
5.4.4 DESIGN OF THE RESEARCH AND MATERIALS ................................................................................. 272
5.4.4.1 Classification and labelling of the data ................................................................................................. 272
5.4.4.2 Measurement of F0 at the rise onset and peak in late peak accents .......................................................... 275
5.4.4.3 Measures of peak delay ....................................................................................................................... 275
5.4.4.4 Problems related to peak location and detection of segment boundaries ........................................... 275
5.4.5 RESULTS: EARLY PEAK ALIGNMENT IN KUNINJUKU ..................................................................... 277
5.4.5.1 Average peak alignment of hat pattern vs non-hat pattern accents ....................................................... 277
5.4.5.2 Effects of the right-hand prosodic context: Prosodic boundary strength and distance in syllables from the boundary .............................................................................................................. 281
5.4.5.3 Effects of right-hand prosodic context: Average peak alignment in phrase-initial vs phrase-final accents ......................................................................................................................................................... 283
5.4.6 DISCUSSION ........................................................................................................................................ 284
5.4.6.1 The effect of contour type on peak alignment ......................................................................................... 284
5.4.6.2 Early peak vs downstepped accents in Kuninjuku hat patterns ................................................................. 285
5.4.6.3 Effects of phrase position on peak alignment .......................................................................................... 288
5.4.7 RESULTS: LATE PEAK ALIGNMENT IN KUNINJUKU .................................................................... 289
5.4.7.1 Late peak accents and utterance-initial position ....................................................................................... 290
5.4.7.2 Effects of left-hand prosodic context: Anacrusis ...................................................................................... 291
5.4.7.3 Effects of left-hand prosodic context: Leading low tone as an explanation for late peak alignment ................................................................................................................................................................. 292
5.4.7.4 Effects of right-hand prosodic context: Tonal crowding in hat pattern contours .................................. 294
5.4.7.5 Effects of right-hand prosodic context: The distribution of late peak accents in relation to foot structure .......................................................................................................................................................... 295
CHAPTER 6

THE LOW PHONOLOGICAL PHRASE BOUNDARY TONE AND OTHER CORRELATES OF PROSODIC CONSTITUENCY

6.1 INTRODUCTION AND OVERVIEW........................................................................................................................................ 327
6.2 LITERATURE ON THE PHONOLOGICAL PHRASE ................................................................................................................ 328
6.2.1 The phonological phrase in non-polysynthetic languages .............................................................................................. 328
6.2.2 The phonological phrase in polysynthetic languages ........................................................................................................ 331
   6.2.2.1 Intonational and prosodic constituency in polysynthetic languages .............................................................................. 331
   6.2.2.2 Phonological phrasing in Cayuga .............................................................................................................................. 332
   6.2.2.3 Phonological phrasing in Lushootseed ...................................................................................................................... 334
6.3 EVIDENCE FOR THE PHONOLOGICAL PHRASE IN KUNINJU ............................................................................................. 336
   6.3.1 Distribution of the low tone (Lp) ............................................................................................................................... 336
   6.3.2 Accent assignment patterns in two-word phonological phrases ...................................................................................... 338
   6.3.3 Rejection of the trailing tone hypothesis .................................................................................................................... 339
   6.3.4 Relative prominence relations between phonological phrases ...................................................................................... 341
6.4 PHONETIC REALISATION OF THE LP TONE AT THREE PROSODIC BOUNDARY LEVELS: 
   ACOUSTIC CUES TO LEVELS OF PROSODIC CONSTITUENCY .......................................................................................... 342
   6.4.1 Literature on scaling and alignment of L boundary tone targets as cues to levels of prosodic 
   constituency ........................................................................................................................................................................ 342
   6.4.2 Aim of the experiment .................................................................................................................................................... 345
   6.4.3 Method and materials ...................................................................................................................................................... 345
   6.4.4 Results: Lp scaling and prosodic boundary strength ...................................................................................................... 348
   6.4.5 Results: Lp alignment and prosodic boundary strength .................................................................................................. 350
   6.4.6 Results: Lp alignment and finality .................................................................................................................................. 352
6.4.7 Discussion: Final lowering as absolute vs relative low F0 level, and its relationship to the percept of finality .......................................................... 353
6.5 Non-tonal acoustic correlates of boundary strength: Duration ................................................. 356
6.5.1 Literature on segmental duration as a correlate of boundary strength ................................356
6.5.2 Aim of the experiment .............................................................................................................. 357
6.5.3 Method and materials .................................................................................................................. 357
6.5.4 Results ....................................................................................................................................... 358
6.5.5 Discussion .................................................................................................................................. 359
6.6 Tonal register as evidence for the phonological phrase ............................................................ 360
6.6.1 Phonetic tone scaling within a prosodic domain .......................................................................360
6.6.2 Aim of the experiment ................................................................................................................ 361
6.6.3 Method and materials .................................................................................................................. 362
6.6.4 Results: Scaling of the Lp tone in relation to the preceding H* peak .....................................362
6.6.5 Sources of variability in the scaling relationship between H* and Lp tones .......................364
6.6.6 Results: Degree of variability in the scaling of H and L tones ...............................................369
6.7 The phonological structure and phonetic behaviour of the Lp boundary tone ......................... 370
6.7.1 Boundary tone types in the autosegmental-metrical literature ..................................................370
6.7.2 The Lp boundary tone and low tone spreading in Kuninjku .......................................................374
6.7.3 Lp deletion and ‘tonal scope’ in high level contours ..............................................................381
6.8 Conclusion ................................................................................................................................... 387

CHAPTER 7

PHONOLOGICAL PHRASING AND PROSODIC INTEGRATION

7.1 Introduction and overview ............................................................................................................. 391
7.2 The concept of prosodic integration ............................................................................................ 392
7.3 Phonological phrasing and prosodic integration in Kuninjku .................................................... 395
7.3.1 Frequency of prosodic integration by lexical class .................................................................395
7.3.2 Phonological phrasing of verbal words .................................................................................. 396
7.3.2.1 Prosodic integration of verbal words ......................................................................................396
7.3.2.2 Phonological phrasing of perception verbs and their complements ..................................403
7.3.3 Phonological phrasing of nominal words ............................................................................. 408
7.3.4 Phonological phrasing of other lexical classes .................................................................... 412
7.3.4.1 Demonstratives .......................................................................................................................412
7.3.4.2 Independent pronominals ...................................................................................................418
7.3.4.3 Possessive pronouns and possessive adjectives .................................................................419
7.3.4.4 Adverbs and prepositions ..................................................................................................422
7.3.4.5 The discourse interjection wanjh .......................................................................................424
7.4 Prosodic phrasing of unaccented words in Kuninjku ................................................................. 426
7.5 Conclusion ................................................................................................................................... 427
CHAPTER 8

CONCLUSION

8.1 DISCUSSION OF MAIN FINDINGS ................................................................................................................ 429
8.2 FUTURE DIRECTIONS ......................................................................................................................................432
List of Figures

Figure 1.1: Template structure of the verbal word in BGW ............................................................................... 20
Figure 1.2: Template structure of the nominal/adjectival word in BGW .......................................................... 20
Figure 1.3: Text and intonation labelling using time-aligned tiers in Transcriber ................................................. 41
Figure 1.4: Downstepped high accent (!H*) on barri-yimeng ........................................................................... 44
Figure 1.5: Downstepped high accent (!H*) on the reduplicant base -bunkurduyh in Kundednjenghmi ......... 45
Figure 1.6: Downstepped high accent (!H*) on bo-yoy ...................................................................................... 45
Figure 1.7: Upstepped high accent (^H*) on the word kanjdji, `underneath`, in Kuninjku. ............................ 46
Figure 1.8: Low phonological phrase boundary tone on the syllable -bom....................................................... 49
Figure 1.9: High initial intonation phrase boundary tone (%H) in MM ...........................................................51
Figure 1.10: Low initial intonation phrase boundary tone (%L) in Gun-djeihmi ............................................... 52
Figure 1.11: Break index 0 (and 1 and 4) in Kunwinjku ......................................................................................54
Figure 1.12: Break indices 1, 3 and 4 in a Manyallaluk Mayali utterance. .........................................................55
Figure 1.13: Break indices 1, 3 and 4 in a Gun-djeihmi utterance ..........................................................55
Figure 2.1: Flat hat pattern contour and simple falling contour in Gun-djeihmi .................................................. 66
Figure 2.2: Flat hat pattern in Manyallaluk Mayali ............................................................................................ 66
Figure 2.3: Low-rising boundary in Manyallaluk Mayali dialect ................................................................. 68
Figure 2.4: Low-rising boundary in Kune dialect ............................................................................................. 68
Figure 2.5: Low rising boundary contour in Gun-Djeihmi ................................................................................. 70
Figure 2.6: Low-rising boundary in Kunwinjku ............................................................................................... 71
Figure 2.7: Low-rising boundary in Kunwinjku ............................................................................................... 71
Figure 2.8: Low-rising boundary in Manyallaluk Mayali .................................................................................. 72
Figure 2.9: High level contour, with F0 target at the peak setting the F0 level for the remainder of the phrase. .................................................................................................................................73
Figure 2.10: High level contour in Kundednjenghmi ......................................................................................... 74
Figure 2.11: High tone spread from an initial accent target to the end of the utterance .................................... 75
Figure 2.12: Use of high level intonation for a topicalised expression ............................................................... 78
Figure 2.13: Use of high level intonation in the first part of an equative construction ........................................ 79
Figure 2.14: Use of high level intonation (with lexical repetition) for a series of repeated actions, culminating in a low boundary at the end of the series .................................................................................. 80
Figure 2.15: Use of high level intonation with the morpheme kuyin, `nearly` ......................................................... 81
Figure 2.16: Use of high level intonation with the morpheme kuyin, `nearly` ......................................................... 81
Figure 2.17: Stylised sustained high contour in Kuninjku .................................................................................. 82
Figure 2.18: Stylised sustained high contour in Kuninjku .................................................................................. 83
Figure 2.19: Stylised sustained high contour with final fall ............................................................................... 84
Figure 2.20: Stylised sustained high contour in Kuninjku .................................................................................. 86
Figure 2.21: Stylised sustained high contour with final fall in Manyallaluk Mayali ........................................... 87
Figure 2.22: Stylised high intonation followed by a low fall across completive particle girrg in Iwaidja .......... 94
Figure 2.23: Polar question contour in Kuninjku (with final emphatic accent) ................................................ 97
Figure 2.24: WH-question contour in Manyallaluk Mayali .................................................................97
Figure 2.25: WH-question contour in Kuninjku......................................................................................98
Figure 2.26: WH-question contour in Kuninjku......................................................................................98
Figure 2.27: Imperative contour in Manyallaluk Mayali ...........................................................................99
Figure 2.28: Prosodic constituent hierarchy and associated intonational events in a Kunwinjku utterance..100
Figure 2.29: Phonological phrase boundary tones (L_p) in Kunwinjku.....................................................103
Figure 2.30: Distribution of pause durations at utterance-level boundaries..............................................105
Figure 2.31: Pierrehumbert (1980)’s finite-state grammar model of English intonation.........................106
Figure 2.32: Finite-state grammar for BGW, showing two divergent paths for the construction of intonational tone sequences in the IP....................................................................................108

Figure 3.1: Wideband spectrogram of gorlomomo navu, showing reduction of the third vowel in gorlombo...121
Figure 3.2: Wideband spectrogram of djalamardawk showing relative lack of intensity of the third /a/ vowel.................................................................126
Figure 3.3: Single-accented, utterance-unique token of na-ngamed..........................................................137
Figure 3.4: Double-accented, utterance-final token of na-ngamed............................................................138
Figure 3.5: Wideband spectrogram of a single-accented token of na-ngamed ...........................................138
Figure 3.6: Wideband spectrogram of a double-accented token of na-ngamed..........................................138
Figure 3.7: Wideband spectrogram of a single-accented token of bi-nguneng ........................................138
Figure 3.8: Wideband spectrogram of a double-accented token of bi-nguneng=wanjh................................138
Figure 3.9: Double-accented, intonation-phrase unique token of kan-veybu ................................................143
Figure 3.10: Double-accented, IP-unique token of a-keb-kan .................................................................145
Figure 3.11: Hat pattern across the verbal word bani-wel(e)ng-bepbe-marne-yaw-bu-rriny .........................146
Figure 3.12: Hat pattern in Gun-djeihmi across ngarri-yauh-maknan .........................................................147
Figure 3.13: Hat pattern in Manyallaluk Mayali across detjnak-dunin .......................................................148
Figure 3.14: Single-accented F0 pattern across bene-marne-yimeng.........................................................149
Figure 3.15: IP-unique, triple-accented token of rawowh-rfurddd-dadjeng ..................................................150
Figure 3.16: Variable accent assignment in na-kudji / na-kudji=wanjh .....................................................152
Figure 3.17: IP-unique, double-accented token of (ng)al-dah-daluk with a single medial accent.................154
Figure 3.18: IP-initial token of (ng)al-dah-daluk .........................................................................................154
Figure 3.19: IP-medial token of the word man-kung .................................................................................156
Figure 3.20: Accent on the closed second syllable of the root in nga-wurlebme........................................157
Figure 3.21: Accent on the closed second syllable of the root in ngal-ngarelyi ...........................................160
Figure 3.22: Accent on the initial open syllable and second closed syllable of modjarriki............................162
Figure 3.23: Token of barri-bepbe-yoy illustrating penultimate accent in Manyallaluk Mayali ....................165
Figure 3.24: Token of ba-yyergani illustrating penultimate accent in Manyallaluk Mayali .........................166
Figure 3.25: IP-unique and IP-initial, double-accented tokens of darrgid-no ............................................168
Figure 3.26: IP-unique token of na-gimuk .................................................................................................171
Figure 3.27: IP-unique token of na-gimuk-gen .........................................................................................172
Figure 3.28: Token of *duruk* with final syllable accent.................................................................175
Figure 3.29: Double-accented token of *na-wernwarre* with final syllable accent ..........................175
Figure 3.30: Two tokens of *judubu*, with and without final syllable accent..................................177
Figure 3.31: Morpheme-final accent on *kurila*, in *kurila-kenh*.......................................................180
Figure 3.32: Morpheme-final accent on *ke*, in *nguuddangke*..........................................................180
Figure 3.33: L+H* accent on a verb-final syllable, -*wam* (Kuninjku)..............................................182
Figure 3.34: L+H* accent on a verb-final syllable, -*mang* (Kuninjku)..........................................182
Figure 3.35: WH-question with accent on the final syllable, -*rren*..................................................184
Figure 3.36: Two repetitions of the (elicited) WH-question *nyale yi-yawan*, both with accent on the final syllable, -*wan*................................................................................................................................185
Figure 3.37: Imperative with accent on the final syllable, -*ray*.......................................................186
Figure 3.38: Imperative with accent on the final syllable, -*wo*..........................................................187
Figure 3.39: Final syllable accent on a token of *judubu*.................................................................191
Figure 3.40: Token of *bene-djal-kang* with accent on *be*-..................................................................194
Figure 3.41: Accentuation of the initial and final feet in the verbal word *gandi-gerre-worrhmen*........196
Figure 3.42: Rising sequence of accents in a Kuninjku utterance, with the strongest prominence in the utterance falling on *maa-berrk*. ..............................................................................................................203
Figure 3.43: Rising sequence of accents in a Kuninjku utterance, with the strongest prominence in the utterance falling on *ku-ngorl*.................................................................................................205
Figure 4.1: An example of syllable labelling in Transcriber, for the utterance *nga-rradjdje nga-yende-dadjke*..............................................................................................................................................224
Figure 4.2: Durations of accented and unaccented CV syllables by word position (phrase-medially) ......227
Figure 4.3: The effect of phrase-final position (IP/utterance) on the duration of penultimate and antepenultimate accented syllables .................................................................................................................230
Figure 4.4: Increased duration of phrase-final accented penultimate syllables relative to unaccented ......230
Figure 4.5: The relatively greater effect of phrase-final lengthening on unaccented CV syllables in word-final vs penultimate positions.................................................................231
Figure 4.6: Boxplots showing the range of peak RMS for accented and unaccented vowels..................233
Figure 4.7: Vowel plot for Kuninjku accented (ai, au, ae, aa) and unaccented (ui, uu, ue, ua) vowels......234
Figure 4.8: Wideband spectrogram showing elision of weak /i/: /b t t l / -> /b t l / ..................................236
Figure 4.9: Double-accented token of the word *birri-kayhmeng*.........................................................237
Figure 4.10: Wideband spectrogram of *birri-kayhmeng*, showing unreduced duration and formant structure in the second /i/ vowel .........................................................................................................237
Figure 4.11: Wideband spectrogram showing elision of the [w] segment in the utterance *kabene-h-rawoyh-borrang*. .................................................................................................................................239
Figure 4.12: Wideband spectrogram showing a clear [w] segment in the utterance *rawoyh-no=wanjh*......240
Figure 4.13: Token of *gotta*, showing sustained RMS and F0 peaks on the unstressed syllable ..............241
Figure 4.14: Wideband spectrogram of \textit{birri-bid-bom} indicating duration of [ɪ] vowels in an initial accented syllable (with a late peak accent), second unaccented syllable, and third accented syllable 

Figure 5.1: Interpretation of ‘peaks’ and ‘elbows’ in the F0 trace as accent-related H tones

Figure 5.2: Early, medial and late peak alignment in German accents (after Gartenberg and Panzlaff-Reuter (1991))

Figure 5.3: Early, medial and late peak alignment in Kuninjku

Figure 5.4: A ‘hat pattern’ peak on \textit{wirriwirriyak} (second accent in the word), followed by a ‘non-hat pattern’ peak on \textit{nume}

Figure 5.5: A ‘non-late’, utterance-initial peak on \textit{njumed}, followed by a ‘non-hat pattern’, phrase-final peak on \textit{nakkunj}

Figure 5.6: A ‘late peak’ accent on \textit{birri-wam=wanjih}

Figure 5.7: Perturbation of the F0 trace in the nasal offset of \textit{ben} and the onset of \textit{-kerre} attributable to the voiced velar stop /g/ (orthographically ‘k’)

Figure 5.8: Peak delay in CUCKOO text: three measures

Figure 5.9: Peak delay in BILLABONG text: three measures

Figure 5.10: ‘Early peak’ pattern with F0 falling from the stressed syllable onset (non-downstepped final accent on \textit{nga-wurlebme})

Figure 5.11: ‘Early peak’ pattern with F0 falling from the stressed syllable vowel onset: non-downstepped final accent in \textit{ nga-wurlebme}

Figure 5.12: Downstepped peak hat pattern: lowered F0 target on the final accented syllable in \textit{bi-marne-wenjhmeng}

Figure 5.13: Correlation between syllable duration and peak delay in late peak accents in Kuninjku

Figure 5.14: Illustration of an emphatic late peak accent in Kuninjku (on the prefix \textit{bene})

Figure 5.15: Illustration of an upstepped late peak accent in Kuninjku (on the prefix \textit{ngune})

Figure 5.16: Correlation between peak F0 and onset F0 in Kuninjku late peak accents

Figure 5.17: Mean peak and rise onset height (Hz) in Kuninjku late peak accents

Figure 5.18: Combined distribution of absolute peak delay (ms) in late and non-late peak accents

Figure 5.19: Hat pattern in Manyallaluk Mayali

Figure 5.20: Flat hat pattern in Kuninjku

Figure 5.21: ‘Raised peak’ hat pattern in Kuninjku across \textit{kanh-korumud-yirridjmeng}

Figure 5.22: ‘Downstepped’ hat pattern in Kuninjku across \textit{bi-marne-wenjhmeng}

Figure 5.23: Phonetic realisation of the raised peak hat pattern contour in Kuninjku

Figure 5.24: Raised peak hat pattern contour in Kuninjku

Figure 5.25: Phonetic realisation of the downstepped peak hat pattern contour in Kuninjku

Figure 5.26: Postaccentual high tone across the syllable \textit{nih} in \textit{kunih}, before an !H* accent on the following word

Figure 5.27: High pitch sustained across the accented foot \textit{kondah}, ‘here’

Figure 5.28: Example of high pitch sustained across the accented foot \textit{bene-} in \textit{bene-bom}

Figure 5.29: Postaccentual high pitch across -\textit{dah} in \textit{ben-dahken-doy}

Figure 5.30: Fall through the accented syllable \textit{beb} in \textit{kambembeng}: no postaccentual high F0

Figure 5.31: Postaccentual high F0 on the final, unaccented syllable \textit{me} in \textit{kambembme}
Figure 6.1: Alignment of low boundary tones ..............................................................337
Figure 6.2: A single phonological phrase, integrating two phonological words ..................338
Figure 6.3: $H^*<$ (late peak) pitch accent at a distance of three unaccented syllables from the edge of the word bene-dapkeng .................................................................340
Figure 6.4: $H^*<$ (late peak) pitch accent at a distance of four unaccented syllables from the edge of the word wirriwirriyak .................................................................340
Figure 6.5: Relative prominence relations between phonological phrases in two intonation phrases........342
Figure 6.6: Illustration of the labelling of phonetic L tone targets for F0 extraction .................346
Figure 6.7: Boxplots of the phonological phrase-final (first plot from left), IP-final (second plot) and utterance-final F0 values (Hz) for $L_p$ ..............................................................................349
Figure 6.8: Utterance with final lowering, $L_p$ tone aligned with the right edge of the final syllable ..........354
Figure 6.9: Utterance with final lowering, $L_p$ tone aligned with the right edge of the penultimate syllable ..........354
Figure 6.10: An utterance with both the final and penultimate $L_p$ tones approaching the baseline, but which lacks a percept of finality (for this analyst) .................................................................355
Figure 6.11: Combined plot of the F0 of the preceding $H^*$ peak vs the following $L_p$ tone in all phrase positions: PhonP-final (p), IP-final (i) and utterance-final (u) .................................................................362
Figure 6.12: F0 (Hz) of $L_p$ tones vs preceding $H^*$ peak values in PhonP-final position ..................364
Figure 6.13: F0 (Hz) of $L_p$ tones vs preceding $H^*$ peak values in IP-final position ..................364
Figure 6.14: F0 (Hz) of $L_p$ tones vs preceding $H^*$ peak values in utterance-final position ...............364
Figure 6.15: Emphatic $H^*$ pitch accent, realised as an ‘extra-high’ pitch peak; the low tone utterance-finally is not correspondingly raised .................................................................367
Figure 6.16: Onset of a sequence of quotative utterances, with raised topline in both IPs ..................368
Figure 6.17: Two kinds of boundary tone (phrase tone and peripheral boundary tone) and their alignment with the segmental tier across the utterance tonal associations .................................................................373
Figure 6.18: Early alignment of the phonological phrase tone with respect to the IP boundary, and subsequent tone spreading .........................................................................................376
Figure 6.19: Continuation of the low F0 level following the $L_p$ tone across the unaccented word kumekke ..................376
Figure 6.20: Alignment of the low target with the right edge of the penultimate syllable in nga-ngadjeng .................................................................377
Figure 6.21: Continuation of low tone across the word-final syllable -bom and unaccented la ..................378
Figure 6.22: Anticipatory rise on syllable -meng of bene-karrmeng ......................................................380
Figure 6.23: Anticipatory rise on -neng before the accented syllable ben- of ben-yakwong ..................380
Figure 6.24: High tone spread between initial accent target and end of IP/utterance .........................381
Figure 6.25: $L_p$ tone target medial in an IP ending in high level F0 ......................................................384
Figure 6.26: $L_p$ tone target medial in an IP ending in high level F0 ......................................................384
Figure 6.27: Representation of $L_p$ deletion in a high level contour ending in H% ......................................385

Figure 7.1: Integration of two verbs into a single phonological phrase in a purposive construction ..........397
Figure 7.2: Integration of two verbs into a single phonological phrase in a purposive construction ..........397
Figure 7.3: Integration of two verbs into a single phonological phrase in a secondary predicate construction ............................................................................................................................399
Figure 7.4: Integration of two coordinated verbs into a single phonological phrase.................................400
Figure 7.5: Integration of two coordinated verbs into a single phonological phrase.................................400
Figure 7.6: Separate phonological phrasing of a perception verb, bene-nang, and its complement, ka-m-djal-re. ........................................................................................................................................403
Figure 7.7: Separate phonological phrasing of a perception verb, ø-nang, and its complement, kabirri-yi-yo ........................................................................................................................................403
Figure 7.8: Separate phonological phrasing of a perception verb, ø-bekkang, and its complement, ka-h-bume ........................................................................................................................................404
Figure 7.9: Separate phonological phrasing of a perception verb, bene-nah-nang, and its complement, ben-bom ........................................................................................................................................405
Figure 7.10: Separate phonological phrasing of a perception verb, birri-nang, and its complement, ka-m-bebme, with a demonstrative also separating the verbs. ........................................................................405
Figure 7.11: Prosodic integration of a nominal, kun-red, and an adjective, djarre. ........................................407
Figure 7.12: Typical phrasing of a verb and postposed nominal object in Kuninjku. ......................................408
Figure 7.13: Typical phrasing of a verb and preposed nominal (co-referential with the (zero) object pronominal prefix). .........................................................................................................................408
Figure 7.14: Typical phrasing of a verb and postposed nominal (co-referential with the subject pronominal prefix bene-). ........................................................................................................................................409
Figure 7.15: Separate phonological phrasing of the demonstrative namekke and the relative clause nunghah=nawu… which elaborates upon the reference of namekke. .........................................................412
Figure 7.16: Prosodic integration of a demonstrative, makka, with a following verb ngurri-bawo.…………413
Figure 7.17: Prosodic integration of a demonstrative, nani, with a following noun na-dabbolkwarre .......414
Figure 7.18: Prosodic integration of a demonstrative, nani, with a following noun garrart.................415
Figure 7.19: Prosodic integration of the independent pronominal nungan with a predicate adjective, darnkih (with intensificatory lengthening of the stressed syllable darn) ........................................................................417
Figure 7.20: Prosodic integration of the contrastive pronominal ngalengman with a following noun, al-badjan........................................................................................................................................417
Figure 7.21: Prosodic integration of an independent pronominal (with discourse marker wanjh encliticised) and verbal word into a single phonological phrase.........................................................418
Figure 7.22: Prosodic integration of an independent pronominal (with discourse marker wanjh encliticised) and verbal word into a single phonological phrase........................................................................419
Figure 7.23: Prosodic integration of locative adverb konda and following verb, yi-nan. .........................420
Figure 7.24: Prosodic integration of preposition kure(h) and following noun, karrikad..............................421
Figure 7.25: Unaccented, encliticised token of wanjh in phrase-final position........................................422
Figure 7.26: Accented, phrase-initial, prosodically integrated token of wanjh..............................................423

Figure 8.1: Intonation phrase-level register shift in a Kuninjku utterance................................................431
List of Tables

Table 1.1:  Sayers (1976): levels of the prosodic hierarchy above the word in Wik-Mungkan ........................................... 10
Table 2.1:  Distribution of texts across dialects, text durations and transcription status .............................................. 61
Table 3.1:  Accent position in verbal phonological words in Kunjinjku ................................................................. 193
Table 3.2:  Accent position in nominal phonological words in Kunjinjku ................................................................. 194
Table 3.3:  Accent position in verbal phonological words in Manyallaluk Mayali .................................................. 194
Table 3.4:  Accent position in nominal phonological words in Manyallaluk Mayali .................................................. 194
Table 4.1:  Mean peak RMS of accented and unaccented vowels ......................................................................... 232
Table 4.2:  Vowel quality (measurements in barks) ............................................................................................. 235
Table 5.1:  Sample size for each peak type .............................................................................................................. 273
Table 5.2:  Differences in mean peak delay/mean peak percentage of syllable/vowel duration by peak type
  (Wilcoxon Rank-Sum Tests (non-parametric test)) ......................................................................................... 278
Table 5.3:  Percentage of peaks aligned before the vowel onset ......................................................................... 278
Table 5.4:  Percentage of phrase-final accents preceding each prosodic boundary type ........................................... 282
Table 5.5:  Number of hat pattern and non-hat pattern peaks in utterance-final and penultimate syllables ...... 283
Table 5.6:  Comparison of the average difference in peak delay between phrase-initial, non-late peaks
  and phrase-final, non-hat pattern peaks (Wilcoxon Rank Sum test) .............................................................. 284
Table 5.7:  Syllable structure of metrically strong syllables associated with late and non-late peak accents
  in BILLABONG and CUCKOO texts ........................................................................................................ 296
Table 5.8:  Duration of late peak and non-late peak CV and CVC accented syllables in BILLABONG and
  CUCKOO texts ........................................................................................................................................ 298
Table 5.9:  Duration of late and non-late peak CV and CVC accented syllables in BILLABONG and
  CUCKOO texts, by prosodic structure ........................................................................................................ 298
Table 6.1:  Distribution of F0 values for Lp (Hz) by phrase position ........................................................................ 348
Table 6.2:  Frequency of penultimate vs final syllable alignment of Lp before phonological phrase-final,
  IP-final and utterance-final boundaries ..................................................................................................... 350
Table 6.3:  Frequency of penultimate vs final syllable alignment of Lp before phonological phrase-final,
  IP-final and utterance-final boundaries, when 1 or 2 syllables separate the preceding H* accented syllable from the boundary ........................................................................................................... 351
Table 6.4:  Distribution of utterance-final Lp tone values (Hz) by alignment ............................................................. 352
Table 6.5:  Vowel duration (ms) of accented (penultimate) and unaccented (final) syllables in PhonP-final,
  IP-final and utterance-final feet .................................................................................................................. 359
Table 6.6:  Correlation between Lp tone values and preceding H* peak values (Hz) by phrase position ............... 363
Table 6.7:  Relative variability of H* tones and Lp tones, by phrase position .......................................................... 370
Table 7.1: Phonological phrasing by lexical class (Kuninjku) ................................................................. 395
Table 7.2: Phonological phrasing of demonstratives (Kuninjku) .............................................................. 411
Table 7.3: Phonological phrasing of tokens of the discourse interjection wanjh, ‘then’ .............................. 422

List of Sound Files

Sound file 1.1 ................................................................................................................................................. 44
Sound file 1.2 ................................................................................................................................................. 45
Sound file 1.3 ................................................................................................................................................. 45
Sound file 1.4 ................................................................................................................................................. 46
Sound file 1.5 ................................................................................................................................................. 49
Sound file 1.6 ................................................................................................................................................. 51
Sound file 1.7 ................................................................................................................................................. 52
Sound file 1.8 ................................................................................................................................................. 54
Sound file 1.9 ................................................................................................................................................. 55
Sound file 1.10 .............................................................................................................................................. 55
Sound file 2.1 ................................................................................................................................................. 66
Sound file 2.2 ................................................................................................................................................. 66
Sound file 2.3 ................................................................................................................................................. 68
Sound file 2.4 ................................................................................................................................................. 68
Sound file 2.5 ................................................................................................................................................. 70
Sound file 2.6 ................................................................................................................................................. 71
Sound file 2.7 ................................................................................................................................................. 72
Sound file 2.8 ................................................................................................................................................. 72
Sound file 2.9 ................................................................................................................................................. 73
Sound file 2.10 .............................................................................................................................................. 74
Sound file 2.11 .............................................................................................................................................. 75
Sound file 2.12 .............................................................................................................................................. 78
Sound file 2.13 .............................................................................................................................................. 79
Sound file 2.14 .............................................................................................................................................. 80
Sound file 2.15 .............................................................................................................................................. 81
Sound file 2.16 .............................................................................................................................................. 81
Sound file 2.17 .............................................................................................................................................. 82
Sound file 2.18 .............................................................................................................................................. 85
Sound file 2.19 .............................................................................................................................................. 85
Sound file 2.20 .............................................................................................................................................. 86
Sound file 2.21 .............................................................................................................................................. 87
Sound file 2.22 .............................................................................................................................................. 94
Sound file 2.23 ..................................................................................................................................................................97
Sound file 2.24 ..................................................................................................................................................................97
Sound file 2.25 ..................................................................................................................................................................98
Sound file 2.26 ..................................................................................................................................................................89
Sound file 2.27 ..................................................................................................................................................................99
Sound file 2.28 ..................................................................................................................................................................103

Sound file 3.1: Utterance-medial token of gorlomono (MM) ................................................................. 120
Sound file 3.2: Utterance-final token of bininj (MM) .................................................................................... 122
Sound file 3.3: Utterance-unique token of daluk (MM) .............................................................................. 122
Sound file 3.4: Utterance-final token of korroko (MM) ................................................................................ 123
Sound file 3.5: Utterance-initial token of ngurrurdu (MM) ..................................................................... 123
Sound file 3.6: Utterance-unique token of djukerre (Kuninjku) .......................................................... 123
Sound file 3.7: Utterance-final token of doddoro (Kuninjku) ................................................................. 124
Sound file 3.8: Utterance-unique token of djalamardawk (Kuninjku) ...................................................... 125
Sound file 3.9: IP-unique token of gabarri-barung (MM) .................................................................... 127
Sound file 3.10: IP-unique token of kabirri-djal-di (Kuninjku) .............................................................. 127
Sound file 3.11: Utterance-medial token of namekke with initial syllable accent ............................. 128
Sound file 3.12: Utterance-initial token of namekke with medial syllable accent .............................. 128
Sound file 3.13: Utterance-final token of na-ngamed (Kuninjku) ......................................................... 132
Sound file 3.14: Utterance-final token of korroko (Kuninjku) ................................................................. 132
Sound file 3.15: Utterance-final token of na-djal-yahwardur (Kuninjku) ............................................... 134
Sound file 3.16: Utterance-initial token of ngal-dah-daluk (Kuninjku) .................................................... 135
Sound file 3.17: Utterance-initial token of kun-dung-kudji (Kuninjku) ................................................ 135
Sound file 3.18: IP-unique token of na-ngamed (Kuninjku) ................................................................. 138
Sound file 3.19: Single-accented, IP-unique token of bi-nguneng (Kuninjku) ................................. 139
Sound file 3.20: Double-accented, IP-final token of bi-nguneng (Kuninjku) ..................................... 139
Sound file 3.21: IP-unique token of kan-weybu (Kuninjku) ................................................................. 143
Sound file 3.22: IP-unique token of a-keb-kan (Kuninjku) ................................................................. 144
Sound file 3.23: IP-unique token of bani-weleng-hephe-marne-yaw-bu-rr-iny (MM) ......................... 146
Sound file 3.24: Utterance-unique token of ngarri-yah-makhnu (Gun-Djeihmi) ............................ 147
Sound file 3.25: Utterance-medial token of detjmak-duninj (MM) ..................................................... 148
Sound file 3.26: Utterance-unique token of bene-marne-yimeng (Kuninjku) ................................ 149
Sound file 3.27: Utterance-unique token of rawoyh-rdurddu-dadjeng (Kuninjku) ... 150
Sound file 3.28: IP-unique token of na-kudji=vanjh and utterance-initial token of na-kudji .......... 151
Sound file 3.29: Utterance-initial token of ngal-dah-daluk (Kuninjku) .............................................. 153
Sound file 3.30: Utterance-final token of ngal-dah-daluk (Kuninjku) .................................................. 154
Sound file 3.31: Utterance-medial token of man-kung (Kuninjku) ...................................................... 155
Sound file 3.32: Utterance-initial token of nga-wurlembhe (Kuninjku) .............................................. 158
Sound file 3.33: Utterance-unique token of ngal-ngarelyi (Kuninjku) ............................................... 159
Sound file 3.34: Utterance-unique token of modjarrik (Kuninjku) .................................................... 162
Sound file 3.35: Utterance-unique token of barri-bephe-yoy (MM) .................................................. 164

XXIII
Sound file 3.36: Utterance-unique token of *ba-yerrgani* (MM) .......................................................... 165
Sound file 3.37: IP-initial token of *barri-gep-dukgani* (MM) ................................................................ 166
Sound file 3.38: IP-initial token of *ba-bawoni* (MM) ........................................................................ 166
Sound file 3.39: IP-medial token of *bani-mirnde-di* (MM) ................................................................. 166
Sound file 3.40: IP-final token of *ga-gof-djejyo* (MM) ...................................................................... 166
Sound file 3.41: Utterance-final and -initial tokens of *darrgidi-no* (MM) ................................................. 167
Sound file 3.42: Utterance-final token of *barri-jan-gayhmi* (MM) ....................................................... 168
Sound file 3.43: Utterance-unique token of *yi-mim-dapgeygi* (MM) .................................................... 168
Sound file 3.44: Utterance-unique token of *na-gimuk* (MM) ............................................................. 170
Sound file 3.45: Utterance-final token of *na-gimuk-gen* (MM) ............................................................. 170
Sound file 3.46: IP-unique token of *duruk* (Kuninjku) ....................................................................... 174
Sound file 3.47: IP-unique token of *na-wernwarre* (Kuninjku) .......................................................... 174
Sound file 3.48: IP-unique, double-accented token of *judabii* with final syllable accent (MM) ........... 177
Sound file 3.49: IP-unique token of *kurlba-kenh*, with morpheme-final accent (Kuninjku) ................ 178
Sound file 3.50: IP-unique token of *nguddangke*, with morpheme-final accent (Kuninjku) .............. 179
Sound file 3.51: IP-unique token of *ngurre-woneng* (Kuninjku) ...................................................... 181
Sound file 3.52: IP-initial token of *burryak* (Kuninjku) ..................................................................... 181
Sound file 3.53: IP-unique token of *ngudda* (Kuninjku) .......................................................... 181
Sound file 3.54: L+H* accent on a verb-final syllable in *birri-wam* (Kuninjku) ................................. 182
Sound file 3.55: L+H* accent on a verb-final syllable in *ngunen-mang* (Kuninjku) ......................... 182
Sound file 3.56: Token of WH-question in MM, *nyalegen nguni-burren?* ......................................... 184
Sound file 3.57: Token of WH-question in MM, *nyale yi-yawan?* .................................................... 185
Sound file 3.58: IP-unique token of imperative utterance in MM, *ngurri-ray!* .............................. 186
Sound file 3.60: IP-unique token of *bene-djal-kang* (Kuninjku) .................................................. 194
Sound file 3.61: IP-unique token of *gandi-gerre-worhmen* (MM) .................................................. 196
Sound file 3.62: Rising sequence of accents in a Kuninjku utterance, with the strongest prominence in the utterance falling on *man-berrk* ................................................................. 203
Sound file 3.63: Rising sequence of accents in a Kuninjku utterance, with the strongest prominence in the utterance falling on *ku-ngorl* ................................................................. 205
Sound file 3.64: Relative prominence relations in the utterance but *name kanjdji bene-yoy* ................ 206
Sound file 3.65: Relative prominence relations in the utterance *konda kanjdji bene-yoy* ................. 206
Sound file 3.66: Relative prominence relations in the utterance but *nani kanjdji bene-yoy* ............. 207

Sound file 4.1: IP-unique token of *birri-dowerrinj* ............................................................................. 236
Sound file 4.2: IP-unique token of *birri-kayhmeng* ......................................................................... 237
Sound file 4.3: Reduced form *-rawh* ............................................................................................... 238
Sound file 4.4: Reduced form *-royh* ................................................................................................. 238
Sound file 4.5: IP-unique token of *kabene-rawoyh-borrong* ......................................................... 239
Sound file 4.6: IP-unique token of *rawoyh-no=wanjh* ..................................................................... 240
Sound file 4.7: Token of *gotta* ........................................................................................................ 241
Abbreviations and conventions

The following abbreviations and conventions are adopted from Evans (in press).

Pertaining to pronominal prefixes:

1  first person
2  second person
3  third person

Subject/object relationships are expressed in the form ‘person of subject/person of object’, e.g. 1/3ua means ‘I acting on the two of them’. Singular number is assumed unless otherwise marked, thus 3 = singular, 3ua = unit augmented (‘the two of them’), 3a = augmented (‘they’).

ua  unit augmented
a  augmented
pl  plural
P  past
h  higher object

Pertaining to noun class and gender prefixes:

I  noun class, typically masculine
II noun class, typically feminine
III noun class, typically vegetable
IV noun class, typically neuter
MA masculine gender agreement
FEM feminine gender agreement
VE vegetable gender agreement
NEU neuter gender agreement

Pertaining to verbal prefixes:

BEN benefactive applicative
COM comitative applicative (same abbreviation is used for the comitative nominal suffix)
IMM immediate
REDUP reduplicant morpheme

1 The distinction singular/unit augmented/augmented is not made for the pronominal object series, but rather a singular/dual/plural distinction; see Evans (in press: §10.2.2) for argumentation on this point.
**Pertaining to verbal suffixes:**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PP</td>
<td>past perfective</td>
</tr>
<tr>
<td>PI</td>
<td>past imperfective</td>
</tr>
<tr>
<td>NP</td>
<td>non-past</td>
</tr>
<tr>
<td>IMPER</td>
<td>imperative</td>
</tr>
<tr>
<td>IRR</td>
<td>irrealis</td>
</tr>
<tr>
<td>RR</td>
<td>reflexive/reciprocal</td>
</tr>
</tbody>
</table>

**Pertaining to nominal prefixes and suffixes:**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEN</td>
<td>genitive</td>
</tr>
<tr>
<td>ERG</td>
<td>ergative</td>
</tr>
<tr>
<td>POSS</td>
<td>possessive</td>
</tr>
<tr>
<td>REDUP</td>
<td>reduplicant morpheme</td>
</tr>
<tr>
<td>LOC</td>
<td>locative</td>
</tr>
</tbody>
</table>

**Pertaining to demonstratives:**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEM</td>
<td>demonstrative</td>
</tr>
<tr>
<td>ANA</td>
<td>anaphoric demonstrative</td>
</tr>
<tr>
<td>ANA.IMM</td>
<td>immediate anaphoric</td>
</tr>
<tr>
<td>IMM.PREV.</td>
<td>just mentioned</td>
</tr>
</tbody>
</table>

**Other miscellaneous:**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONJ</td>
<td>conjunction</td>
</tr>
<tr>
<td>CTRFAC</td>
<td>counterfactual</td>
</tr>
<tr>
<td>NEG</td>
<td>negator</td>
</tr>
<tr>
<td>PRO</td>
<td>pronominal</td>
</tr>
<tr>
<td>REL</td>
<td>relativiser</td>
</tr>
</tbody>
</table>

**Boundaries:**

- morpheme boundary
. lexicalised or fused morpheme boundary
= clitic boundary

---

2 The higher object series of pronominal prefixes (bi-, kabi-) is used when the object of an action is ranked higher in animacy than the subject, thus, ‘the man bit the dog’ would be glossed ‘man 3/3-bitePP dog’ but ‘the dog bit the man’ will be glossed ‘man 3/3h-bitePP dog’.
Tables of phoneme inventories and orthographic conventions

The following tables are adapted from Evans (in press).

A. Phoneme inventories and orthographic conventions (Evans, in press)

<table>
<thead>
<tr>
<th>Manner of articulation</th>
<th>Place of Articulation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Peripheral</td>
</tr>
<tr>
<td></td>
<td>bilabial</td>
</tr>
<tr>
<td>Short stop</td>
<td>b</td>
</tr>
<tr>
<td></td>
<td>(p, b)</td>
</tr>
<tr>
<td>Long stop</td>
<td>p:</td>
</tr>
<tr>
<td>Nasal</td>
<td>m</td>
</tr>
<tr>
<td>Lateral</td>
<td>l</td>
</tr>
<tr>
<td>Rhotic</td>
<td>r</td>
</tr>
<tr>
<td></td>
<td>(r, ɾ)</td>
</tr>
<tr>
<td>Semi-vowel</td>
<td>w</td>
</tr>
</tbody>
</table>

Table A.1: Consonant phoneme inventory (IPA symbols) and allophonic variants (in brackets)

Short stop consonants vary in voicing depending on word position and voicing of adjacent consonants. They are always unaspirated and tend to be voiced in syllable onset and voiceless in syllable coda positions. Stops are generally unreleased in word-final position. Long stops are principally distinguished phonetically by duration (Evans, in press: § 2.3.1), but also tend to be voiceless.
There is no evidence at present for positing /i/ or /u/ as the underlying vowels; the default pronunciation is closer to /ɪ/ and /ʊ/, with closer variants tending to occur in some post-accentual and word-final syllables (see Chapter 4 in relation to variations in vowel quality). The closer allophone of /ɪ/ is also heard following a palatal consonant or semi-vowel.

<table>
<thead>
<tr>
<th>Place of Articulation</th>
<th>Peripheral</th>
<th>Apico-</th>
<th>Lamino-</th>
<th>Glottal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>bilabial</td>
<td>velar</td>
<td>alveolar retroflex</td>
<td>palatal</td>
</tr>
<tr>
<td>Short stop</td>
<td>p</td>
<td>k</td>
<td>d…d</td>
<td>rd…rd</td>
</tr>
<tr>
<td></td>
<td>(b…p)</td>
<td>(g…k)</td>
<td>(d…t)</td>
<td>(rd…rt)</td>
</tr>
<tr>
<td>Long stop</td>
<td>bb (pb)</td>
<td>kk (kg)</td>
<td>dd (td)</td>
<td>rdd (rtd)</td>
</tr>
<tr>
<td>Nasal</td>
<td>m</td>
<td>ng</td>
<td>n</td>
<td>rn</td>
</tr>
<tr>
<td>Lateral</td>
<td>l</td>
<td>rl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rhotic</td>
<td>rr</td>
<td>r³</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semi-vowel</td>
<td>w</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Gun-Djeihmi conventions differ from Kuninjku/Kunwinjku only in the use of ‘g’ syllable-initially and ‘k’ in syllable-final position.

³ It may seem perverse to represent the retroflex phoneme by a single ‘r’ and the alveolar phoneme by a doubling of the symbol, ‘rr’; however, these are the conventions currently used for the representation of rhotic segments in BGW. Conventions vary considerably across Australian language orthographies: Breen (1992), for example, uses ‘r’ for the alveolar tap or trill and ‘rr’ for a retroflexed glide in his treatment of Kukatj segmental phonology.
BGW also has a set of eight diphthongs. Evans (in press) analyses these as sequences of a vowel and a semi-vowel, phonemically. The orthographic conventions for diphthongs differ between dialects, and are given in Table A.5.

| Orthographic conventions for diphthongs (sequences of vowel +semi-vowel) (Evans, in press: § 2.2). |
|---|---|---|

### Table A.5

<p>| Kuninjku/ Kunwinjku/ MM | Gun-Djeihni |</p>
<table>
<thead>
<tr>
<th>Diphthongs</th>
<th>Diphthongs</th>
</tr>
</thead>
<tbody>
<tr>
<td>iw ew aw ow ey ay oy uy</td>
<td>iu eu au ou ei ai oi ui</td>
</tr>
</tbody>
</table>
Map

Location of Bininj Gun-wok dialects and neighbouring languages (reproduced from Evans, in press)
Chapter 1

Introduction

The fundamental questions are only coherent when taken together: what are the basic entities, how do they combine, and what are the observable consequences of particular combinations of such entities? We find it unfortunate that (for historical reasons) the first two questions have been the principal domain of phonology, while the last one has been taken to be the (largely independent) concern of phonetics. One of our aims has been to demonstrate the value of a unified approach. (Liberman and Pierrehumbert, 1984: 202.)

[It is our conviction that the more central issues can hardly be approached fruitfully without the tools lower-level analysis has provided: it is useless to try to examine why or under what conditions potentially communicatively relevant events occur in intonation as long as the means to describe these events adequately are lacking. (t'Hart and Cohen, 1990: 175; emphasis added)]

1.1 Aims of the dissertation

The primary aim of this dissertation is to provide a systematic, auditory and instrumental, analysis of the ‘basic entities’ of intonation and prosody in the polysynthetic Australian language Bininj Gun-wok¹ (henceforth BGW), and their phonetic appearance when combined. The research is couched in the framework of autosegmental-metrical theory.

There are two principal motivations for the analysis of intonation and prosody in BGW. The first is to provide input to the developing field of intonational-prosodic typology, from the perspective of a language which is typologically interesting on at least two counts: (a) its genetic position – relatively little is known about the intonation of languages from the Australian language family; and (b) its polysynthetic character. I use the term ‘intonational-prosodic typology’ to describe the project of extracting universal and language-specific parameters across the dimensions of both intonation and prosody. Intonation is dependent on the prosodic features to which it associates; as Fox (2000: 328) observes:

¹ Also referred to as Mayali.
languages of various prosodic types, with different tonal and accentual features, can be said to have the same kinds of intonational features – envelope [principally pitch range and level - JB], prominence and modality [intonational features chosen paradigmatically - JB] – but these features may be implemented and realized in different ways, and these different realizations depend on non-intonational features of the prosodic structure of the language.

The second aim of this dissertation is to complement the existing grammatical analysis of Bininj Gun-wok (Evans, in press), adding to the detailed documentation of this language. Although not currently endangered, the entire dialect chain of Bininj Gun-wok has approximately 1,000 first-language speakers (Evans, in press). With possibly only of half these varieties presently being acquired by children (Kuninjku, Kunwinjku and Kune), its future cannot be said to be secure.

A related aim is to make available to the readers of this dissertation all auditory and visual evidence relevant to the descriptive and theoretical propositions it contains. Though the time required to produce quantities of sound files is, admittedly, prohibitive, the advancement of the field of intonational typology will almost certainly require the rigorous standards of evidence which the presentation of auditory records of new language data may help to establish. This is especially the case in relation to languages for which data is not readily available. If auditory data is presented, it becomes possible to test the analysis of the data against analyses of other languages, or further data from this language.

A description of the intonational and prosodic phonology of a language requires, minimally, the prior existence of a description of the segmental phonology, including the set of syllable structures and stress assignment rules, and of word construction and morphology. In the course of my research on Bininj Gun-wok, I have been fortunate to have at hand an immensely detailed phonological, morphosyntactic, semantic and pragmatic description of the language in *Bininj Gun-wok: a pan-dialectal grammar of Mayali, Kunwinjku and Kune* (Evans, in press). This has motivated my endeavours to draw connections between the intonational and prosodic phonology I describe and elements of the language detailed in the grammar — between metrical stress and pitch accent (Chapter 3), clause relations and phonological phrasing (Chapters 6 and 7), and
intonational boundary tones and semantic and pragmatic coherence (Chapters 2 and 7). The analysis presented in this thesis also provides the groundwork for future research into the relationship between patterns of accent assignment, relative prominence and information structure (see Chapters 3 and 7, and §1.3 below).

1.1.1 The project of intonational-prosodic typology

A number of studies have addressed the project of developing an intonational-prosodic typology. The project nonetheless remains in its infancy, in large part due to the scarcity of detailed descriptions of intonation and above-word prosody in non-Indo-European languages, including Australian languages (see §1.3 below). The most recent cross-linguistic surveys of intonation and prosody include Jun (ed., in press); Fox (2000); Hirst and di Cristo (1998); Ladd (1996); Vaissière (1983, 1995, 1997, 1998); Nespor and Vogel (1986); and Bolinger (1978); see Fitzpatrick (2000) for an overview of the state of intonational typology.

Only a few of these studies refer to a language either from the Australian family or a polysynthetic language. Ladd (1996: 131) cites King’s (1994) description of an emphatic intonation pattern in the Australian language Dyirbal. Bolinger (1978: 486) refers to a Western Desert language in which a final monosyllabic clitic carries an emphatic accent, observes that yes-no questions in Warlpiri “rise steadily from beginning to end” (1978: 494), and lists the main intonational features of Pintupi. Nespor and Vogel (1986) and Fox (2000) refer to existing studies of word stress assignment in two Australian languages, Yidiɲ and Maranungku. Jun (ed., in press) includes a chapter by Bishop and Fletcher on the Bininj Gun-wok intonational inventory and BGW-ToBI transcription system, and a chapter by Gordon detailing the intonation patterns and above-word prosody of a mildly polysynthetic language, Chickasaw. Ladd (1996) speculates that “in some languages – the languages of western Siberia and the American Northwest are possible examples – there are no core tones at all, only edge tones” (1996: 149). He describes hearing recorded narratives in Chuckchee, a highly polysynthetic

---

2 Here I concur with Fitzpatrick (2000), who observes, “written descriptions are not reliable as the sole source upon which to make rigorous observations and generalisations [relating to intonation]”. (2000: 88)
language of north-eastern Siberia, and an unidentified language of British Columbia, in which

... impressionistically, the only salient pitch movements are rises at the beginnings of intonational phrases, after which the pitch remains level until the next phrase break; this could be analysed as an initial LH boundary tone. [...] I offer the speculative analysis only to show how readily such languages could be accommodated in the descriptive framework made possible by the linear phonological view (1996: 149)

1.1.2 Definitions of key terms

The term ‘intonation’ is defined in this dissertation as regular, postlexical tonal events produced at phonologically specified points in an utterance – such as metrically strong syllables and prosodic boundaries. Structurally, intonation may serve delimitative (boundary-marking) and culminative (head-marking) functions in relation to prosodic structure. It may also serve more general prominence-lending functions.

The terms ‘delimitative’ and ‘culminative’ were originally employed by Trubetskovoy (1939; French transl., 1949) to describe two non-distinctive, structural functions of prosody in relation to the phonological word unit. The culminative function highlights the metrical ‘head’ of the word unit (i.e. primary stress), thereby allowing the number of units to be determined; the delimitative function serves to indicate where the boundaries of the units lie. Beckman (1986) expands the use of the two terms to include larger phrasal units, above the level of the phonological word, and it is this sense of the two terms which I adopt in this thesis. I also specifically define the term ‘prominence-lending’ as the use of intonation to render any word or syllable – whether or not it is the structural head of a prosodic constituent – more pitch-prominent than other words or syllables within a phrase. This is in order to distinguish the essentially structure-marking, culminative use of pitch accent from the use of pitch-prominence as an indicator of the most informationally salient word or morpheme in an utterance3.

The term intonation is also used in this thesis to refer to the conventional (systematic phonetic) ways in which F0 transitions between tonally specified points are

---

3 The two uses may coincide in certain languages (such as the Australian language Wik-Mungkan: see §1.3.1), but in a cross-linguistic perspective, it is useful to distinguish them.
carried out. Finally, I use the terms ‘prosody’ and ‘prosodic structure’ to refer to the phonological structures which underlie rhythm in a language: the metrical structures and prominence relations at foot, word and above-word levels, and levels of phrasing.

1.2 Intonation and prosody in polysynthetic languages

1.2.1 Previous studies of polysynthetic languages

A ‘polysynthetic language’ is defined in Comrie (1989: 45) as a language in which “it is possible to combine a large number of morphemes, be they lexical or grammatical, into a single word, often corresponding to a whole sentence of English”. Comrie further defines an ‘incorporating’ subtype of polysynthetic language, where “[i]ncorporation refers to the possibility of taking a number of lexical morphemes and combining them together into a single word” (1989: 45), distinguishing this from polysynthetic languages such as Eskimo, in which a single lexical morpheme combines with a number of grammatical morphemes.

There is an increasing interest in the intonation and prosody of polysynthetic languages, particularly those spoken in North America and Alaska. However, few recent studies have been published in widely available publications or presented in an international forum. Those accessible at the time of writing include Gordon (in press): Chickasaw; Dyck (2001): Cayuga; Beck (1999): Lushootseed; Taff and Wegelin (1997, 1998) and Taff et al., (2001): Unangan; Nagano-Madsen (1993) and Nagano-Madsen and Bredvad-Jensen (1995): West Greenlandic Eskimo; McDonough (1999): Navajo; and Mithun (1995): various. The literature indicates that the prosody and tonal phonology of languages described as polysynthetic covers a broad spectrum of possibilities, from lexical pitch accent (varieties of Salish), phrasal tones delimitative of a phonological phrase unit, without accentual tones (Unangan, West Greenlandic Eskimo, possibly Chuckchee), stress with lexical pitch accent (Chickasaw) to lexical register tone (Navajo). I am not aware of any polysynthetic language other than Bininj Gun-wok for which a ‘pure’ stress accent classification has been established\(^5\).

\(^4\) Fundamental frequency (F0) is the principal acoustic correlate of tone; the auditory (psychoacoustic) correlate of tone is referred to as pitch.

\(^5\) Although I retain the term ‘stress accent’ in this dissertation, the use of the term for BGW may be somewhat misleading (Bishop, 2002; Chapter 4 in this dissertation). It is not clear, for example, that the traditional stress
1.2.2 Polysynthetic languages and the role of intonation and prosody in relation to information structure

Polysynthetic languages call out for examination from the perspective of the relative functional load of intonation and prosody, morphology (e.g. focus or emphatic particles) and word order in the manifestation of information structure. In polysynthetic languages which allow lexical incorporation, such as BGW, the morphosyntactic verbal unit may carry several lexemes which in more analytic languages would constitute single words. This is especially the case in those languages which allow incorporation of one or more nominal lexemes in the verbal word (such as BGW). Other lexemes affixed to the verbal word in BGW include adverbial and quantifying lexemes. The fact that a great deal of information is carried by lexical and inflectional morphemes on the verbal word raises questions as to how information structure is conveyed in such a language.

Cross-linguistically, information structure frequently bears a relationship to prosodic and intonational structures. The term ‘information structure’ describes the system of attentional relations to propositional and lexical content manifested in a given language, and the management of changes in those relations. The information structure component of a language minimally includes its management of activation states and identifiability, topicality, contrastive focus and information focus (or non-contrastive emphasis) (Lambrecht 1994; Grosz and Sidner, 1986).

There are numerous ways in which information structure may utilise the prosodic and intonational resources of a language. These include the selection of particular intonational tunes (cf. Pierrehumbert and Hirschberg, 1990; Ward and Hirschberg, 1985; Steedman, 2000); manipulation of prosodic structure (removing or adding culminative or delimitative prosodic events, i.e. accents and boundary tones); and modifications of intonational structure (modifications of the pitch range (scaling) or the alignment of intonational events) (cf. Gussenhoven, 1984; Ladd, 1983a, Ladd and Morton, 1997). The following examples illustrate the latter two uses of intonation and prosody.

correlates of duration, intensity and full vs reduced vowel quality are systematically associated with metrically strong, pitch accented syllables in the language. In Bishop (2002), I propose the alternative term ‘metrical accent’.

6 Among Australian languages, Nunggubuyu, a polysynthetic language related to BGW, does appear to associate high pitch with metrically strong syllables (Heath, 1984: 32).

7 For example, Gartenberg and Panzlaff-Reuter (1991) posit a relationship between the lateness of a high accent peak and emphasis in German. A similar relationship has been found in English emphatic accents, together with a modification in scaling (Ladd and Morton, 1997). In Japanese, “pitch range can be expanded on individual lexically
In the Aleut language Unangan, each word typically constitutes a phonological phrase that is delimited by an H tone at its onset and an L tone at its end (Taff and Wegelin, 1997; Taff et al., 2001). These two tones index the location of phrase edges in the prosodic structure: they are ‘structure-marking’. In addition to the delimitative role of the phrasal tones, Taff and Wegelin (1998) suggest that adjustments in the pitch range of this phrasal intonation may be used to signal contrastive focus. Specifically, a raising of the H tone may be used to assign focus to a nominal word that is not initial in the utterance. This raising occurs against a default background of successive lowering of the phrasal contours within a single utterance. This use of pitch range is what Ladd (1996: 269) refers to as an ‘extrinsic’ effect, that is, an effect that is orthogonal to the tonal string, but modifies the realisation of one or more elements of the string.

Similarly, in relation to register tone languages, Fox (1995, cited in Fox, 2000: 327) gives evidence of a process by which emphatic “prominence [is] obtained by raising (or, in the case of the low tones, lowering) the pitch of individual syllables” in Mende, Cantonese and Mandarin Chinese (also see Ladd, 1996: 195). I have chosen these examples to illustrate that in languages in which the location and type of tones is either structure-marking (Unangan) or lexically distinctive, modifications of pitch range may enable a further, prominence-lending, use of tone. These prominence-lending pitch range modifications categorically alter the interpretation of the utterance, by changing its focus structure.

However, pitch range modifications do not necessarily fulfil a prominence-lending function. In Navajo, also a lexical register tone language, local modifications of the pitch range of tonally specified syllables fulfil structure-marking functions. In an instrumental-phonetic study, McDonough (1999: 518) found “pitch expansion in the stem syllable” (H tones are raised, L tones lowered), and “resetting of F0 at the disjunct-conjunct boundary” [a significant word-internal morphological boundary – JB]. Thus in Navajo, modifications of pitch range are used to mark the location of significant elements and boundaries in the morphological structure (i.e. the stem of the word, and the disjunct-conjunct boundary), rather than to directly bring discourse-salient information into focus.

---

specified pitch accents to convey focus or emphasis effects similar to those conveyed by postlexical pitch accents in languages such as English.” (Pierrehumbert and Beckman, 1988, cited in Ladd, 1996: 195)
In Seoul Korean, in which intonation is accentual phrase-delimitative, the phrase-delimitative function can be manipulated in the service of information structure. The intonational contour of the accentual phrase itself lends a certain perceptual prominence to the phrase-initial word. When a word carries contrastive focus in Seoul Korean, it initiates a new accentual phrase, and any following words within the intonational phrase are incorporated into a single accentual phrase with the focused word (a process known as ‘dephrasing’). In this manner, the prominence of words following the focused word is decreased. (Jun, 1996: 162-169)

In stress accent languages such as English, German and Dyirbal, the location of intonational accents varies both according to the inherent accentability and the information structure status of the lexical items in an utterance, within limits determined by the prosodic structure of the intonational phrase (see Ladd, 1996: Chapter 5 for a detailed account of language-specific constraints on accentuation across languages).

Although the present dissertation cannot address at length the issues raised in this section (but see Chapter 3, §3.12), the description of intonation and prosody I propose in this thesis provides a basis for future research on interactions between intonation, prosody and the manifestation of information structure in BGW.

1.3 Previous studies of intonation and prosody in Australian languages

Very few systematic intonational descriptions exist for indigenous Australian languages. Fletcher and Evans (1998, 2000) and Bishop and Fletcher (1999, in press) describe elements of the intonational phonology of Bininj Gun-wok (see § 1.4). Sayers (1976) approaches a comprehensive coverage of the intonational phenomena of Wik-Mungkan, a language of the Cape York Peninsula in Queensland, using a modified tagmemic descriptive framework. King (1994) is a detailed autosegmental-metrical description of declarative intonation patterns in Dyirbal, a language once spoken in Northern Queensland. King (1999) is an analysis of high onset accent patterns in Dyirbal and Warlpiri, a language spoken in Central Australia. There are other notable, but more sparse, observations relating to intonation in Baker’s (1999) dissertation on word structure in Ngalakgan; Heath’s (1984) grammar of Nunggubuyu, a language of the Arnhem Land coast; Pym and Larrimore (1979), a set of papers on the phonology of
Iwaidja, a language spoken on Croker Island, off the coast of the Northern Territory; Sharpe’s (1972) grammar of Alawa, a language traditionally spoken in Arnhem Land; Marsh (1969), an article on the phonology of Mantjiljara, a language of central Western Australia; and an article by Hansen and Hansen (1969) on the phonology of Pintupi.

Research is currently in progress into the intonation of Kayardild, the traditional language of Bentinck Island off the coast of North-West Queensland (Fletcher, Evans and Round, 2002); Dalabon, a language closely related to Bininj Gun-wok (Fletcher and Evans, 2000; in press); Iwaidja (Birch 1999, 2002); and Warlpiri (King, in prep.; Pentland, in prep.). In the following sections I will detail four of the more elaborate descriptions available. I will then present an overview of the present state of intonational and prosodic typology in Australian languages.

1.3.1 Wik-Mungkan (Sayers, 1976)

Wik-Mungkan belongs to the Pama-Nyungan family of languages. The verb bears person, tense, aspect and mood suffixes; there is little other inflectional morphology. Primary word stress generally falls on the initial syllable, with secondary stress on alternate syllables. At present estimates, Wik-Mungkan is one of the stronger Australian languages, with between 900 and 1000 first or second language speakers (Schmidt, 1990). No work has been published on the intonation of the language since Kilham (1977), which slightly modifies the prosodic hierarchy presented in Sayers (1976).

Sayers’ (1976) description of Wik-Mungkan intonation is a richly detailed and immensely suggestive account. It is clear that in Wik-Mungkan, high pitch serves a culminative or head-marking function within phrases. One or more shapes of high pitch accent are associated with syllables which bear primary word stress, and one such accent is culminative within a prosodic domain which Sayers refers to as the Phonological Clause. Intonation in Wik-Mungkan also serves a significant delimitative function, with the right edge of the Phonological Clause unit bearing a range of boundary tunes (see Table 1.1).

The location of culminative accentual prominence within a phrase is not fixed in Wik-Mungkan, but conditioned by a complex combination of lexical, grammatical and discourse-focus-related factors. Certain principles appear to be default: culminative
prominence falls on the word preceding the verb in the phrase, unless it is a pronoun; on the WH-pronoun in a WH-question; and on the verb, in a phrase containing only pronominal referents. Word order is an important indicator of information structure: fronting is one of the principal devices used to indicate a new topic, or reiterate the present topic of the discourse (Kilham, 1977: 12).

Sayers posits a prosodic hierarchy with two levels above the level of the word: the Phonological Clause and the Phonological Sentence. The prosodic and intonational correlates of these units are outlined in Table 1.1 below. Her description of the Phonological Clause as the ‘rhythm wave’ indicates that it is the primary rhythmic and intonational unit of the language (1976: 6). The Phonological Sentence is the next-highest level of prosodic unit, and the prosodic domain in which relative prominence relations are contracted between the culminative accents of adjacent Phonological Clauses.

<table>
<thead>
<tr>
<th>Phonological Clause</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Usually one prominence ‘peak’ within the unit (but potentially two: Kilham 1977: 36);</td>
</tr>
<tr>
<td></td>
<td>• Peak is louder and higher pitched than other syllables, and coincides with a primary word stress;</td>
</tr>
<tr>
<td></td>
<td>• Pitch of word stresses preceding the peak within the clause is progressively upstepped;</td>
</tr>
<tr>
<td></td>
<td>• Usually bounded by pauses, but some instances of ‘merged’ or integrated p-clauses without intervening pause;</td>
</tr>
<tr>
<td></td>
<td>• Range of boundary tunes on the final syllable: low, high, mid (or downstepped high - JB), high-low, low-mid (or low rise - JB). No low-high boundary tune recorded.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Phonological Sentence</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Bounded by obligatory pause;</td>
</tr>
<tr>
<td></td>
<td>• One prominence ‘peak’ (highest p-clause peak in a sequence of p-clauses).</td>
</tr>
</tbody>
</table>

Table 1.1: Sayers (1976): levels of the prosodic hierarchy above the word in Wik-Mungkan

Kilham (1977) argues for an additional level of phonological organisation to those posited in Sayers (1976), namely the ‘phonological paragraph’, principally on the basis of high pitch reset at the onset of some discourse units: “[t]he intonation centre of the first
sentence of a paragraph is generally considerably higher than the intonation centre of the last clause of the preceding paragraph.” (1977: 135)

Sayers’ description of modifications in pitch range and level within phonological clauses are particularly interesting: such modifications are an aspect of intonation which remains poorly represented within current ToBI-style models (the present description included; but see Chapter 5, §5.6.4.1, and Evans et al. (1999) for preliminary comments on modifications of this kind in BGW). Her intonational analysis is strongly combinatory. Each intonational tune is considered a composite of two parts: the body of the contour, primarily distinguished by modifications of overall pitch range and level, and the tail, comprising F0 movements which occur in the phrase-final syllable. Each segment of the tune does not appear to be independently meaningful: rather, different combinations are together associated with utterances displaying particular discourse and grammatical functions.

Sayers distinguishes four combined modifications of pitch range (or span) and level (or register) within the body of the phonological clause: neutral range and neutral level; compressed range and elevated level; neutral/slightly compressed range and lowered level; and expanded range and neutral level (1976: 38). These modifications are intended to be phonological and contrastive. Compressed range and elevated level is used across subordinate clauses of various kinds, which may end in either a high or a low boundary tone (1976: 57). With a high boundary, and in utterance-initial position, a high and compressed pitch range indicates topicality. Neutral level and expanded range is used for various kinds of emphatic utterance, sometimes together with a specific emphatic clitic. These phrase-final, monosyllabic clitics may also carry a high-low boundary tune. Neutral or slightly compressed pitch range and lowered level is used with relative clauses, asides and afterthought utterances, reportative clauses preceding or following direct quoted speech, and phrases which describe the final action in a sequence. For example, lowered level is used on the phrase meaning ‘then they found the place’ in the utterance ‘they rowed and rowed and then they found the place’. The preceding phrase in the utterance has high sustained intonation and vowel lengthening indicating continuous action with a long duration (1976: 61).
There are some intriguing parallels in these uses of pitch range and level to pitch modifications used, for example, in English, and also to those in BGW. Further research into the uses of pitch range in this language would no doubt make a significant contribution to the typology of intonation.

1.3.2 Dyirbal (King, 1994)

According to Dixon (1972, cited in King, 1994: 11), Dyirbal “is a typical Australian language (of the Pama-Nyungan group). It is entirely suffixing, largely agglutinative, and has extraordinarily free word order”. There are no remaining fluent speakers of Dyirbal.

The predominant word stress pattern is primary stress on the initial syllable, with secondary stresses on alternating syllables, except for the final syllable, which is extrametrical. Dyirbal shows both head- and edge-marking intonational events. Pitch accents, which have the shape (L)H*L, associate to primary stressed syllables in the intonation phrase. The intonation phrase has minimally one pitch accent, but may have two or three. Delimitative boundary contours are found at the right edge of intonation phrases. Three contours are observed after the final accent: a default low fall; a low fall with a high rise in the final syllable; and a slight rise between the final accent and the boundary (analysed as a phonetic variant of the high rising terminal).

The principles determining the assignment of pitch accent to a word are complex: nominal and verbal constituents always bear accent, but the precise location of the default accent within the constituent is determined by the relative accentability of the words and word order preferences bearing on the grammatical word class of lexical items (King 1994: 107-108).

King (1994:111) suggests that word order in Dyirbal is also pragmatically conditioned, as it is in many Australian languages, including BGW: “Dyirbal speakers deliberately position the most salient information at the beginning and at the end of an intonation phrase”. These are also the positions in which words are most likely to be accented in Dyirbal: “The positioning of the first and final accents on the first syllable of the first and the final words of an intonation phrase has a predictability of at least 83%.” (1994: 111) Like Russian (Comrie 1981, cited in King, 1994: 107) on the one hand, and Lakhota, Omaha, Caddo and Tuscarora (Mithun, 1995) on the other, Dyirbal associates
peripheral positions in the intonation unit with different kinds of pragmatic and prosodic prominence: relatively free word order allows pragmatically salient words to be moved into one or both peripheral positions in order to gain prosodic prominence. However, as already mentioned, in Dyirbal, pragmatic conditioning of accent is complicated by interactions between the grammatical word class of lexical items, their relative accentability and preferred word order (such interactions may also be present in Wik-Mungkan: verbs rank above pronouns in accent assignment, for example).

1.3.3 Kayardild (Fletcher, Evans and Round, 2002)
Kayardild is a dependent-marking (suffixing) language of the Tangkic family\(^8\) (non-Pama-Nyungan). There are fewer than ten remaining speakers. It has relatively free word order and primary stress on the initial syllable. This pilot study of Kayardild suggests that high tones are used freely – possibly in conjunction with stressed syllables, i.e. as high pitch accents – to “highlight particular lexical items, as in many other intonation languages” (2002: 298). That is, high pitch performs a prominence-lending function. Intonation is also delimitative in Kayardild: potentially contrastive F0 movements are observed at both the left and the right edges of an intonation unit.

Some lexical items in Kayardild are associated with distinctive intonation patterns (as are certain Wik-Mungkan emphatic clitics\(^9\)). Such patterns of association are referred to as ‘intonational clichés’ in Hirst and di Cristo (1998), and are quite common across languages. In Kayardild, a counterfactual particle, maraka, is accompanied by a low-rising contour, while an emphatic ‘counter to expectations’ particle, nginja, tends to occur “with an H tone target realized in expanded range” (2002: 298).

1.3.4 Iwaidja (Sayers and Pym, 1977; Pym and Larrimore, 1979; Birch 1999, 2002)
Iwaidja is a head-marking language of the Iwaidjan family\(^10\) (non-Pama-Nyungan). There are approximately 150 speakers (Birch, 1999). Verbal words carry obligatory person/number prefixes and optional mood/tense prefixes; verbal suffixes indicate

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\(^8\) The Tangkic family is only distantly related to Gunwinjguan (Fletcher, Evans and Round, 2002).
\(^9\) “The [emphatic] clitic –âw has a downward pitch glide with crescendo. The pitch on –âw optionally starts either higher or lower than the pitch of the syllable with clause-stress.” (Sayers, 1976: 68)
\(^10\) The Iwaidjan family is remotely related to Gunwinjguan (Evans, in press: § 1.3.2).
tense/aspect/mood and reciprocity. There is little nominal morphology. Iwaidja does not possess elaborate prefixal morphology, showing “subject and object agreement, but practically no other verb-prefixal morphology and no noun incorporation” (Evans, in press: §1.3.2).

Birch (1999) reanalyses a narrative described impressionistically in the tagmemic framework by Pym and Larrimore (1979), in addition to new narrative data. The analysis demonstrates that Iwaidja is a stress accent language, with prominence-lending and delimitative uses of F0. Using an instrumental analysis and an autosegmental-metrical framework, Birch presents a preliminary inventory of intonational pitch accents and intonational boundary tones, and discusses the relationship between metrical stress and intonation. The latter is the subject of ongoing investigation (Birch 2002, in prep.).

The intonational inventory include three pitch accent types: high (H*), downstepped high (!H*) and low-rising (L+H*), and three boundary contours: low falling (L%), sustained high (H%) and high-rising (^H%). The potential locations of intonational pitch accents are the heads of one or more feet (typically not more than two) within verbal words. Feet are left-headed, and the initial syllable of a monomorphemic word is generally strong, though an initial extrametrical syllable is not uncommon in trisyllabic monomorphemic words (Birch, 1999:23). Intonation phrase-medially, a pitch accent is typically associated with the head of the first foot only of a polypedal word. When a polypedal word is a single intonation phrase, accents may be associated with both the initial and the final feet of the word (Birch 1999: 19). Variations in metrical structure produced in connected speech by processes such as encliticisation of a monosyllabic connective or discourse particle to a verbal word, and coalescence of word-final and word-initial vowels, forming heavy syllables with long vowels, may create accentable feet across a domain larger than a single morphosyntactic word. To date, there is no clear evidence bearing on the distinctive levels of prosodic phrasing present in Iwaidja. There is also no data relating to interactions between grammatical word class and accentability.

Sayers and Pym’s impressionistic transcriptions of intonation and “intonation centres” (the most pitch-prominent syllable in a phrase) suggest that the relative prominence of pitch accents is used to direct the attention of the listener to particular elements of information. However, as in BGW (Fletcher and Evans, 1998), the narrative
dynamics of Iwaidja are such that reiterated information often repeatedly occurs with an intonational accent (emphatic or otherwise). Repetition (and associated givenness) do not preclude accentual prominence, as is typically the case in southern British English, for example: “...it is well known that accent tends not to be placed on elements that are repeated or ‘given’ in the discourse...” (Ladd, 1996: 175). There are also many other languages in which repetition or givenness do not correlate with deaccenting (Ladd, 1996: 175-176).

1.3.5 Overview of intonational-prosodic typology in Australian languages

The preceding sections have outlined a number of earlier studies of intonation and prosodic structure in Australian languages. The following is a summary of the relevant typological dimensions, based on these and other references to intonation and above-word prosody in the Australianist literature.

1.3.5.1 Postlexical vs lexical uses of tone
There are no known cases of Australian languages with lexically distinctive tone (Evans, 1995: 753).

1.3.5.2 Delimitative uses of tone
All the Australian languages described exhibit phrase-delimitative intonational contours, such as low falling, high sustained and/or (low or high) rising (Dyirbal, Iwaidja), and rise-fall (Wik-Mungkan). These contours principally occur at the right edge of phrases, but may also be found at the left edge (Kayardild). No Australian language has yet been described as having phrase-delimitative intonation only.

1.3.5.3 Culminative and prominence-lending uses of tone
All the Australian languages described associate postlexical tones (pitch accents) with one, and sometimes two or more, metrically strong positions in the word. In languages

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11 It may be worth investigating whether there is an implicational hierarchy of boundary contours, such that a language with, say, a complex rise-fall boundary will also tend to have the full set of simpler rising, falling or sustained level boundary contours.

12 Heath (1984: 32-33) transcribes high pitch on up to four stressed syllables within morphosyntactic words in Nunggubuyu. However, it is not clear whether each of the high pitch diacritics is intended to correspond to a distinct
which allow more than one pitch accent on a word, one accent location will be default, i.e. the required location of accent when only one is assigned to the word (Ngalakgan, Iwaidja). The default location of pitch accent is frequently the word stem or root, but may be elsewhere in the word (typically, on a word-peripheral foot).

In languages where the assignment of accents to words is structurally or grammatically conditioned, relative prominence among accents (pitch range modification) may be used ‘dynamically’ to highlight the most discourse-salient information in a given phrase. Alternatively, the relative prominence of accents may itself be conditioned by grammatical word class (see below).

1.3.5.4 Lexical and grammatical conditioning of intonation

Interactions between grammatical word class and accent assignment are observed in some languages: i.e. hierarchies of default or preferred accent assignment within and between syntactic constituents (Dyirbal, Wik-Mungkan). However, it is not always clear from descriptions whether it is actually accent assignment (presence or absence of accent) or the relative (pitch) prominence of accents within a phrase which is conditioned by grammatical word class.

Conventionalised associations of intonation contours with specific lexical or propositional content (intonational clichés) have been observed in Kayardild.

1.3.5.5 Relationships between intonation, prosody and information structure

Information focus (emphasis) and contrastive focus are variously manifested by emphatic particle (Diyari: Austin, 1981: 182-184; Nunggubuyu: Heath, 1984: 609), sometimes with specific intonation (Wik-Mungkan); by an additional accent on a metrically weak or

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pitch movement. It may be that transitional high pitch between initial and final accents (i.e. a hat pattern) is responsible for Heath’s percept of multiple, high pitched stressed syllables in the word.

13 Baker (1999: 35): “Pitch accents in Ngalakgan are associated with two positions in words: their primary affiliation is to roots. They have a secondary affiliation with the last strong beat in a word. They cannot be associated with any other positions.”

14 Sharpe’s description of Alawa suggests it is relative accent prominence: “Phrase stress is very much more prominent than word stress… It occurs on grammatically predictable elements of the utterance. In a phrase containing a verb phrase, [phrase] stress occurs on the predicative negative if one is present, otherwise on the verb root. In other phrases, [phrase] stress occurs on the head word of a noun phrase… Weaker stresses may occur on noun phrase heads not receiving the primary stress in a phonological phrase.”
otherwise generally unaccented syllable in the word (Dyirbal, Mantjiltjara\(^1\)); and by prominence-lending, additional F0 height and/or intensity on an already accented syllable, relative to other accents within a phrase (Dyirbal, Wik-Mungkan, Iwaidja).

Austin (1981: 182-184) also describes the use of suffixes to indicate other aspects of the information state of referents in Diyari. These include a suffix indicating a given referent or one that is new but identifiable (-\(\tilde{a}\)), and a newly introduced referent (-\(\tilde{a}\)). He comments that “in most other languages of the world, word order and intonation are the main means of expressing these discourse concepts”. The implication is that intonational means of conveying information structure are not used in conjunction with these suffixes.

Preposing of new, topicalised or focused referents appears to be common in ‘free’ word order Australian languages. The preposed expression frequently forms a separate intonation phrase, often with a conventionally associated intonational boundary contour (such as high or rising) (e.g. Nunggubuyu (Heath, 1984: 603-604), Wik-Mungkan).

1.3.5.6 Contrastive modifications of the tonal space (pitch register)
Contrastive uses of raised or lowered pitch register across entire phrases are observed in some languages (Nunggubuyu (Heath, 1984: 602), Wik-Mungkan). The pitch range of local pitch movements within such phrases may be normal or compressed.

High and compressed pitch register tends to be associated with backgrounding, subordination, quoted speech and topicality; lowered pitch register with ‘afterthought’ constructions and quotative framers (Wik-Mungkan, Nunggubuyu).

1.4 Features of BGW relevant to intonation and prosody (Evans, in press)

1.4.1 Syllable structure and syllable weight
The syllable structure template for BGW is as follows (Evans, in press: §2.4.1; S = sonorant; C –occlusive = a non-occlusive consonant, i.e. a liquid or a semi-vowel; L = liquid, N = nasal, h = glottal stop):

\(^{15}\) Marsh (1969: 148) observes that “[i]n the teaching or emphatic intonation contour, the prepause word is marked by a primary stressed nucleus. In words of up to three syllables the nucleus is composed of the last syllable. In words of four or more syllables the nucleus may be composed of either the last or the penultimate syllable. The nucleus is extra loud,
A high proportion of all syllables are closed (Evans, in press: §2.4, Fletcher and Evans, 1998). BGW differs in this respect from languages of the Pama-Nyungan family. In verbal words, closed syllables tend to cluster toward the end of the word. Most syllables in the pronominal prefixes are open.

BGW has long stops which are not geminates, though they are written as doubled symbols (see Tables A.1 and A.3 at the outset of the thesis). Long stops syllabify as a single syllable onset with relatively long duration (e.g. *kukku* ‘water’ (Kuninjku) => [ku.k:u], *nganapbaru* ‘bullock’ (MM16) => [ŋa.na.p:a.ru]). In contrast, identical consonants occurring across a morpheme boundary have a clear double articulation (e.g. *yi-bok-kan*, ‘you follow the tracks’ (Kuninjku) => [ji.bok’.gan] or [ji.bok’.kan]).

BGW shows weight sensitivity in very limited circumstances. This weight sensitivity affects the placement of accent. A pitch accent which would usually associate with the morpheme-initial syllable of a verbal or nominal stem may associate with a following syllable instead if the morpheme-initial syllable is open (CV) and the following syllable is closed (see §3.6 in Chapter 3 for further discussion).

1.4.2 Morphosyntactic structure

Bininj Gun-wok has largely agglutinative morphology. The two obligatory, ‘fusional’ zones of pronominal prefixes and tense/aspect/mood suffixes aside (see Figure 1.1 below), most morphemes are phonologically unaltered in combination. The verbal word may carry seven or eight morphemes, and never fewer than two (one of which may be a zero morpheme).

The principal word classes in BGW are verbal and nominal words. BGW is a typical polysynthetic language in its verb-centredness: Evans (in press: §5.1) observes that

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high and long.” The primary stressed nucleus in Mantjiltjara usually falls on the initial syllable of the word  (Marsh 1969: 147).
[n]ominals and their morphology play a relatively minor role in Bininj Gun-wok. Many clauses only contain an inflected verb, with no overt nominal word, and where the latter do occur they often lack any inflection showing their syntactic role in the clause…

In transitive and ditransitive clauses, external nominals are often omitted once reference has been established:

Out of a sample of 105 transitive and ditransitive clauses from monologic texts, just over half (54) had no external nominal group, most of the remainder (44) had just one external nominal group, and only seven had two (Evans in press: § 13.2.1).

The verbal word in BGW has the morphosyntactic template structure shown in Figure 1.1 below (adapted from Evans, in press: §8.1). The shaded ‘slots’ are obligatory, the bracketed slots optional. Slot -12 carries a past/present distinction when the subject is third person. Slots -3 and -4 are for incorporated nominals (‘generic’ incorporated nominals include morphemes such as bolk, ‘place’, bo, ‘liquid’ and dulk, ‘tree’). Slots 6 and 7 are interchangeable in order. The ‘miscellaneous’ slot hosts a range of adverbial morphemes, such as darnh, ‘close up’, djal, ‘only’, and bebbe (bepbe in the Manyallaluk Mayali dialect orthography) ‘separately, each one on its own’ (Evans, in press: §8.1.2). The relative linear order of the remaining slots is fixed\(^{17}\), but it is never the case that all slots are filled at the one time. A Manyallaluk Mayali utterance, bani-weleng-bepbe-marne-yaw-bu-rr-iny (3dualPast – then – separately – benefactive – baby – hit–each.other –perfective) translates as ‘Then the two of them fought each other over the baby’, illustrates the filling of slots (-12 (zero prefix), -11), (-7) (twice), (-6), (-4), (0), (+1) and (+2). A verbal word of such complexity is, however, unusual: the majority of verbal words in any given text have one or two morpheme slots filled between the pronominal prefix and the root.

\(^{16}\) Orthographic conventions differ across the dialects. Somewhat misleadingly, long stops in Manyallaluk Mayali are written as a sequence of a voiced plus a voiceless stop, that is, in the same manner as a sequence of two short stops across a syllable boundary (see Tables A.1 and A.3 for details).

\(^{17}\) There are no distinctions of scope dependent on the order of morphemes within the word, as in the polysynthetic language Slave, for example (Rice, 1993).
Nominal and adjectival words share a largely overlapping morphological template, while demonstratives share a subset of the same morphological possibilities (e.g. reduplication for intensifying number, or, in adjectives, quality). The nominal/adjectival template given in Evans (in press, §5.1) is as follows (Figure 1.2).

The following briefly summarises information presented in detail in Evans (in press: §5.1). The prefix slot (-1) may be filled by a locative, pronominal, or, most commonly, a noun class prefix. Most nominals cannot occur as bare stems, but minimally require one of these prefixes to be present. Ordering among the suffix slots is tentative; it is very rare for more than two suffixes to occur in combination. The derivational slot (+1) is used to derive complex referential expressions, such as *gakkak-migen*, ‘pair who call each other *gakkak*’ or *bamurru-djahdjam*, ‘place where magpie geese live’. The possessive slot (+2) is typically filled with the third person singular suffix, *no*; in the Manyallaluk Mayali and Kune dialects this suffix is frequently used instead of the neuter noun-class prefix with body part and part of landscape nouns. The adnominal slot (+3) is filled by suffixes such as *dorreng*, ‘with, having’ or *yak*, ‘lacking’, in constructions where the quality in
question is predicated of another noun, e.g. bigibigi nawu gun-balem-yak, ‘that pig (has) no fat on it’. The role slot (+4) contains the most elaborated set of possibilities, including ablative, instrumental, ergative, genitive and locative suffixes. The tense slot (+5), which is filled only by the past tense morpheme ni and the irrealis marker niwirrinj, is used to derive a nominal predicate, as in, for example, nga-wurdurt-ni, ‘I was a child (at the time)’.

1.4.3 Word order

The main principles of word order are detailed in Evans (in press: §13.2.2), and summarised below. Word order of nominal and adjunct expressions is conditioned by information structure in the following ways:

- New, reintroduced and constrastive referents generally occur preverbally.
- Established referents and non-salient referents incidental to the theme typically occur post-verbally. An example of a non-salient referent is a group of children chattering while a hunter pursues a crocodile, where the hunt is the principal theme: barri-nyaknyak wurdu-wurdurd, ‘they were chattering away, the kids’.
- New referents introduced using presentative, existential or thetic constructions generally also follow the verb (see Evans (in press: §13.3.4) for further details of these constructions). Nominal expressions in these contexts may elaborate a more general nominal incorporated in the existential verb immediately preceding, e.g. ga-bo-yo an-gabo, ‘it-liquid-lies vegetable.class.marker-billabong’, ‘There’s a billabong there’.
- Adjunct expressions which appear post-verbally on an initial mention may subsequently occur in pre-verbal position, i.e. be fronted, as a ‘linking’ device.

There are also a few syntactic constraints on ordering, such as within prepositional phrases (e.g. kure ku-wardde (LOC. LOC-stony.country) ‘in the stony country’, but *ku-wardde kure18) and amongst demonstratives (e.g. nani nawu, but *nawu nani). Pronominal expressions in BGW often include pronominal uses of demonstratives or

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18 This sequence is not ungrammatical, but cannot be used to convey the meaning ‘in the stony country’.
demonstrative phrases, such as *nani nawu*, ‘that one (we can both identify)’, or *nakka*, ‘that (masculine) one just mentioned’. The phrasing of verbal, nominal, pronominal and adjunct expressions at the level of the phonological phrase is discussed in Chapter 6.

1.4.4 Previous descriptions of stress, accent and intonational phrasing

Fletcher and Evans (1998, 2000) analyse Bininj Gun-wok as a stress accent language. Drawing on data from the Gun-Djeihmi and Kun-dedjnjenghmi dialects, Evans (1995, in press) and Fletcher and Evans (1998, 2000) observe that ‘primary word stress’ generally falls on the head of the final non-monosyllabic foot. Feet are left-headed in BGW, and metrical structure below the level of the phonological word is assigned on the basis of morphological structure (Evans, 1995:755; in press). In the Gun-Djeihmi and Kun-dedjnjenghmi dialects, the syllable bearing primary stress is most often the penultimate, and typically corresponds to the root morpheme in verbal words. Fletcher and Evans label four kinds of intonational pitch accents in the vicinity of metrically strong syllables: high (H*), mid-level or ‘downstepped’ high (!H*), low-rising (L+H*) and low (L*) (the latter occurring rarely: “only one or two instances”). In Chapters 3 and 4 of this dissertation I provide evidence for the first three accent types in the Kuninjku and Manyallaluk Mayali dialects; the last (L*) is not attested in the present corpus for the latter dialects. Fletcher and Evans (1998) also observe that deaccenting does not appear to be a feature of BGW. Words that are ‘given’ in the discourse context may not only bear accent, but frequently bear repeated emphatic accent (see Chapter 2, §2.6 for a brief discussion of accent and information structure in the Kuninjku dialect).

Fletcher and Evans (1998, 2000) describe an intonation phrase unit that is bounded at its right edge by one of three kinds of contour: low falling (denoted L%), high sustained level (denoted H%) and low-rising (denoted LH%) (Fletcher and Evans, 2000: 28). Successive intonation phrases may decrease in pitch range and register, forming “groups of phrases [that] seemed to function like a speech paragraph” (2000: 30). Certain phrases are observed to end in a particularly low boundary, suggestive of a ‘final lowering’ of the boundary low tone in these cases, which may be a correlate of discourse chunking (2000: 36).
Fletcher and Evans (1998, 2000) and Bishop and Fletcher (1999) also raise the possibility of a tonally marked level of phrasing below the intonation phrase, “akin to the intermediate phrase of English or accental phrase of Korean or French”, but defer examination of the issue. In Chapter 5, I argue that such a level of phrasing must be posited in order to account for the regular occurrence of a Low tone, which aligns with the right edge of a unit I will call the Phonological Phrase.

Carroll (1995), a study of verbal art in the Kunwinjku dialect of BGW, provides a detailed quantitative analysis of the rhetorical function of pause in Kunwinjku, in conjunction with a basic and impressionistic intonational analysis and discussion of variations in articulation rate within pause units. The latter are related to plot development: “…Kunwinjku narrators will vary their articulation rate as part of their verbal art” (1995: 116). Intonation (or ‘tone’) units are simply characterised as ‘final’ and ‘non-final’; no detail is given regarding non-peripheral pitch movements within the unit: “pause units are grouped into tone units with the final pause unit having a falling intonation pattern” (1995: 118). I have produced a partial intonational transcription of one of the texts used by Carroll in his study (see Chapter 2, §2.1.1, for an inventory of texts used in this dissertation), but have not otherwise sought to correlate the latter, impressionistic analysis with the transcription conventions produced in the course of this dissertation.

1.5 The autosegmental-metrical framework

1.5.1 The components of an autosegmental-metrical analysis

Autosegmental-metrical theory dictates the basic principles of tune-text association, the anchoring of tones to the heads and edges of prosodic constituents. An intonational inventory defined within AM theory consists of a phonemic set of tones, each diacritically marked for the type of prosodic head or edge to which it associates.

Two kinds of intonational events are represented in the intonational inventory of a stress accent language: intonational pitch accents and boundary or edge tones. Intonational pitch accents are tones which are diacritically marked in the underlying tone string for association to the head of a foot. They correspond to one of the two primary perceptual functions of intonation in a stress accent language: the production of peaks of
psychoacoustic prominence in morphemes. Boundary tones are tones which are diacritically marked in the underlying representation for association to the right or left edge of a prosodic constituent. The perception and production of boundary tones fulfils the second primary function of intonation: the division of the stream of speech into tonally demarcated phrases.

As the term ‘autosegmental-metrical’ suggests, there are two components to the theory. In each component, certain elements are proposed to be universal and other elements are assumed to vary in language-specific ways. The universal component of autosegmental theory is the notion of linear tiers of phonological objects coordinated in time by association lines. The type and number of phonological objects found in the tone tier, and their patterns of association with the segmental and prosodic tiers, are language-specific. In metrical theory, the division of segmental strings into prosodic constituents at various hierarchical levels is assumed to be universal. The particular levels of constituency used, their phonetic manifestation, and the direction of head assignment in a given prosodic constituent, are all language-specific.

The autosegmental tiers relevant to intonation are the segmental tier, the syllable (CV) or timing tier and the tonal tier. The linearity of association between the tonal and other tiers is assured by the principle that association lines may not cross (Goldsmith, 1990). The notion of the tier itself is a formal linguistic universal, on a par with the notion of the transformational cycle of rules in generative segmental phonology (Chomsky, 1965: 29). It delimits the types of behaviours which constitute the grammatical system. The named tiers are substantive universals: they embody the claim that certain types of linguistic objects are universal. Thus, autosegmental-metrical theory provides both the formal and substantive universals with which the intonational grammar of a language is constructed.

AM theory does not in itself provide a basis for constraining the interactive behaviours (e.g. phonologically-triggered upstep of a sequence of high boundary tones) or the phonetic implementation of tonal elements manipulated by the intonational grammar. In order to use AM representations as input to speech synthesis systems, Bruce (1977) and Pierrehumbert (1980) each elaborated a notion of ‘phonetic implementation’ (‘join rules’ in Bruce) modelled in terms of phonological tone targets (the objects of the
tonal tier), their interpretation in F0 values, and specific kinds of F0 interpolations between them. This is sometimes referred to as a ‘target-interpolation’ model of intonation.

Despite these elaborations, there remain considerable degrees of representational freedom in the AM framework as used in ToBI-style transcriptions, which may cause the analyst difficulties in deciding between competing representational possibilities for given phenomena. Although the adequacy or otherwise of particular elements of Pierrehumbert’s (1980) systematisation of English intonation, and the later ToBI transcription system (Pitrelli, Beckman and Hirschberg, 1994) have been variously debated, no set of general principles for assessing the adequacy of competing intonational grammars, such as the cline of adequacy developed in Chomsky (1965, 1972) for syntactic grammars, has yet been adumbrated for grammars of intonation.

1.5.2 The application of AM theory and the phonetic implementation model to BGW

In this study, I have applied the basic ‘target-interpolation’ model of phonetic implementation derived from Pierrehumbert (1980) and Bruce (1977) in a quite literal manner, on the assumption that there is extensive transparency in the relationship between phonological tone specifications and their phonetic interpretation in terms of continuously varying fundamental frequency. Goldsmith (1990) argues that in general underlying representations [should] match surface forms as much as possible; but this is not a principle either inside a grammar or, for that matter, in a repository of Universal Grammar: it is a general property of how a system learns, when its inner representations are set up to correspond to outer form, as a child must do when acquiring [a language].

In relation to BGW, there is no evidence for any abstract relationships between the underlying tonal ‘score’ and its realisation as a sequence of tone targets in the F0 trace. In certain tone languages, for example, sets of behaviours characteristic of H or L tones enable analysts to suggest that a tone which surfaces with a high F0 value may yet be underlingly a L tone (cf. for example, Westphal, 1962 on Venda, cited in Cassimjee, 1992:7)\(^{19}\). Tone languages are also frequently analysed as having abstract ‘floating

\(^{19}\) As far as I am aware, there are no complexities of this kind in any stress accent language.
tones’. These are tones without an association line to the segmental tier, whose presence is inferred from their effects on adjacent tones in the tonal tier. For example, a low floating tone is commonly postulated on the basis of its effect on an upcoming high tone, which it lowers. This lowering is referred to as ‘downstep’ in the lexical tone literature. Pierrehumbert (1980: §4.2) adopts a similar analysis in relation to the English bitonal accent H*+L, arguing that the trailing L of the accent is not realised as a low tone target, but that the presence of the tone can be inferred nonetheless on the basis of a downstep effect on the following accent. However, this is the only accent for which she posited a tone that is only indirectly observable in the F0 trace. As Ladd (1996: 89-90) observes, Pierrehumbert’s motivation for doing so was essentially theory-internal: to preserve a hypothesis that the lowering of non-initial high accent targets in English is phonetically triggered by a sequence of HLH tones.

In my analysis of BGW, phonological tone specifications are recognisable by F0 movement toward a perceptibly new target value, either ‘high’ or ‘low’ relative to surrounding F0 values. I say ‘perceptibly new’ since, as t’Hart points out, “…it is counter-intuitive to imagine that any speaker intends to produce sounds and sound variations that might not be perceptible.” (t’Hart, 1984: 195)\(^{20}\) I also concur with t’Hart that

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\text{… the relevant pitch movements are related to corresponding activities on the part of the speaker. These [pitch movements] are assumed to be characterized by discrete commands to the laryngeal musculature, and should be recoverable as so many discrete events in the resulting pitch contours. (1984: 195; emphasis added).}
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1.5.3 The phonetic description of tonal phenomena

The fundamental frequency (F0) contour represents one of the three axes of a phonetic description of tonal phenomena, namely, the acoustic axis. Acoustic science aims to describe the physical qualities of sound waves. Considered in their purely acoustic aspect, F0 contours are not linguistically interesting, given the “…inability of the machine to distinguish between linguistically relevant and irrelevant aspects of the acoustic signal.” (Schuetze-Coburn, Shapley and Weber, 1991:78) Writing in 1943, Pike advocated the use

\(^{20}\) Although a speaker’s relative inattention, at times, to the production of particular sound variations may cause them to be produced in a less perceptually salient manner than if the speaker is paying specific attention to the perceptibility of the variation.
of an “instrumental acoustic technic” as the phonetic descriptive method which “seems to make one of its greatest contributions in analyzing prosody. Its accuracy goes infinitely beyond that of the auditory approach.” However, he warned, “here lies its greatest danger; whatever is more refined than the ear can record becomes unsuitable for a phonetic classification.” (Pike, 1943: 28)

When F0 contours are aligned with corresponding segmental material, regularities in the alignment of F0 changes (or plateaux) with the segmental string may be observed. Also apparent will be the alignment of F0 features with non-tonal prosodic phenomena, such as stress, or prosodic junctures from the syllable up. Such regularities are still no guarantee of linguistic interest; they must be passed through the filter of the auditory system to determine their auditory perceptibility, and if auditorily perceptible, through the filter of linguistic categorisation (linguistic perception).

The second and third axes of phonetic description are the articulatory axis and the auditory axis. Knowledge of the articulatory bases of intonational (post-lexical) and lexical tones, particularly low tones, is still sparse, though slowly increasing. The difficulties of establishing a correspondence between the acoustic dimension of F0 variation and changes in cricothyroid and sternohyoid muscle tension are well documented in Erickson, Honda, Hirai and Beckman (1995). Despite the relative paucity of knowledge about the mapping between the articulatory parameters of F0 and linguistic categorisation, hypotheses about the articulatory dimension serve as an important constraint on the present description. These hypotheses are undoubtedly an idealisation; it remains to be seen how robust an idealisation. For example: in the context of this study and numerous other studies (though not always explicitly), a turning point evident in the F0 contour is hypothesised to be the more or less direct result of a command to the laryngeal muscles which control F0 variation. The timing (or ‘alignment’) of this complex muscular ‘gesture’ is co-ordinated with the segmental string, or prosodic elements therein. The magnitude (or ‘scaling’) of the gesture is also controlled. While this understanding of F0 turning points as indexing articulatory gestures is undoubtedly a simplification, it is one which enables us to establish a tentative connection between the acoustic record and the speaker’s control of F0 production. In fact, without some such connection, the acoustic F0 record would be essentially linguistically uninterpretable. In
this study, I interpret an F0 turning point as indexing the punctual nexus of the onset of one gesture and the offset of another. The F0 turning point analysis seems apt for other languages also, for example, in Swedish (Bruce, 1977). In Yoruba, too, a High ‘level’ tone H “is realised as a rise after L [a Low tone - JB] and L is realised as a fall after H.” (Connell and Ladd, 1990: 22).

However, though some connection is necessary, it need not always be specified in terms of phonetic turning points. A single gesture can also be set at a particular magnitude and sustained, as in a high F0 plateau begun and maintained at the level of 200Hz, for example. Under certain circumstances, gestures associated with like tones may result in a single acoustic trajectory, rather than a number of discrete trajectories, as when an underlying sequence of High tones produces a single F0 rise. This is attested in Yoruba, for example, as the consequence of the local raising of a final H tone in a sequence of H tones, before an L tone (Connell and Ladd, 1990: 17); or in English, when a sequence of an H- intermediate phrase tone and an H% intonational boundary tone are produced on a monosyllable.

With regard to the auditory domain, we are interested in the auditory effects (or lack of effect) of F0 changes, i.e. the mapping between audition and relative F0, and not between audition and absolute F0 (see Johnson, 1997: 54 - 56 on absolute F0 audition). House (1990) is a useful text on the perception of relative F0 in the context of linguistic perception. Studies of the audition of absolute F0 are, however, relevant to the hearing of intonation, as they illustrate our greater sensitivity to F0 differences at lower frequencies (e.g., in speech, between 100 and 150Hz) than at higher frequencies (e.g. 300 - 350 Hz).

In this dissertation, I adopt the position that the F0 contour, together with the constraints and filters on analysis discussed above, forms a logical starting point for an investigation of the intonational phonetics and phonology of a language, and the interface between the two. Acoustic data forms the nexus – if a fuzzy one – between the speaker’s production (articulation) and the hearer’s perception (physical audition and linguistic patterning). Unless perceptual data is associated with acoustic data – in this case, the F0 trace – the connection between the perceptual patterns and the speaker’s production remains impressionistic.
A procedure of starting out from acoustic data will undoubtedly seem inverted to those who concur with the view expressed in Brazil (1997:171), namely: “…the investigation of the physical correlates of the meaning-carrying categories is an entirely separate task, logically dependent on prior recognition of what these categories are.” Elsewhere, however, Brazil admits that phonetic descriptions cannot in fact be side-stepped: “…the only research procedure available is to make tentative phonetic observations and try to associate them with generalisable meaning categories.” (1997:4) The impetus to begin this study on the basis of acoustic data and move toward meaning, rather than the converse, was the impossibility of beginning with meaning in the study of a language of which the author is not a native or near-native speaker or hearer. Even in English, which has the most-studied intonational system of any language, much remains to be discovered about the relationship between intonation and meaning, and the nature of intonational meaning (see the discussion in Ladd (1996: 98-102)). It is not at all clear that “intonational meaning” is a viable starting point for the study of intonation even in the better known languages of the world. This study seeks to demonstrate (together with King (1994)) that important insights into the intonational structure of a language, and ultimately, the relationship of the intonational structure to meaning, can be gained by a non-native speaker combining auditory analysis with a careful examination of regularities in the acoustic record.

1.6 **Choice and development of a transcription system**

A number of frameworks for intonational and prosodic transcription have been developed in the past ten to twenty years. Every transcription system is shaped by the specific goals of its developers and manner of its development. Among the more recent, and widely known, transcription systems are ToBI (Tones and Break Indices: Silverman et al., 1992; Pitrelli, Beckman and Hirschberg, 1994; Beckman and Ayers Elam, 1997); INTSINT (INternational Transcription System for INTonation: Hirst and di Cristo, 1998); IViE (Intonational Variation in English: Grabe, 2001) and IPO (developed at the Instituut voor Perceptie Onderzoek, Eindhoven: t’Hart, Collier and Cohen, 1990; t’Hart and Collier, 1979). Of these, the developers of INTSINT and IViE have particularly emphasised the need for a phonetic transcription system which can be used in the initial stages of
capturing intonational and prosodic data in as yet undescribed, or incompletely described, languages (INTSINT) or varieties of a single language (IViE).

All of these transcription systems annotate F0 movements at selected ‘target points’ in the F0 contour. ToBI, INTSINT and IViE label static F0 target levels in the contour. IPO annotations label more complex sequences of tone targets – rises and falls – integrating the direction of F0 movement with information about its alignment, rate and magnitude of change. In the following section I describe the transcription system adopted in this dissertation, ToBI, and briefly compare it with the INTSINT system, which likewise aims to produce descriptions that are comparable across typologically distinct languages.

1.6.1 ToBI

1.6.1.1 The original development of ToBI
The ToBI system of intonation and prosody transcription developed out of two “core prosody transcription” workshops which brought together speech scientists seeking to establish conventions for the transcription of “an agreed-upon set of prosodic elements” in English. The expectation was that the resultant ease of data sharing (following upon transcription of large spoken text corpora) would facilitate “the pursuit of diverse research purposes and varied technological goals” relating to the intonation and prosody of English. ToBI was expressly developed for the transcription of three dialects of English which are relatively homogeneous in their intonational inventories: general American, standard Australian, and southern British English. (Beckman and Ayers Elam, 1997)

1.6.1.2 ToBI and tonal phonology
A central aspect of the ToBI transcription system is its adoption of the constraints of the autosegmental-metrical theory of intonation, as developed in Pierrehumbert (1980), and described in section 1.6 above. This theory provides ToBI, and related transcription systems, with a coherent and explicit model of tonal phonology, and the interaction of the tonal and prosodic phonology. Such a model provides a significant check on the kinds of representation which may be posited within the transcription system. Taken together with
Pierrehumbert (1980)’s and Bruce (1977)’s elaboration of the phonetic implementation module, AM theory carries strong, and potentially falsifiable, hypotheses about the nature and range of behaviours manifested by the tonal objects manipulated by the phonology of intonation.

ToBI transcription systems label tone target points according to their scaling (a) relative to the immediately preceding F0 level and (b) within the F0 range of the prosodic unit determined to be the ‘scaling unit’ in the language in question (at the end of such a phrase unit, the local F0 range used by the speaker may be ‘reset’ upward or down, or else maintained at similar levels). Two level tones are labelled: H and L. Tones may also be labelled as ‘downstepped’ (lowered, in relation to the height of the immediately preceding accent), or ‘upstepped’ (raised). The underlying tone identity of downstepped and upstepped tones is H, therefore a downstepped tone is annotated !H, using the downstep diacritic !, and an upstepped tone may be annotated ^H, using the upstep diacritic ^21. No ToBI system allows !H or ^H to occur phrase-initially, as these diacritics always indicate the presence of a scaling relationship to the preceding H tone.

Diacritics are used to indicate the various prosodic entities with which tones associate. In English ToBI, the star diacritic (*) denotes a tone which is associated with a stressed syllable; the addition sign (+) indicates a tone which forms a phonological unit together with a starred tone, i.e. a bitonal accent; a superscript hyphen (–) marks the association of a tone to an intermediate phrase boundary; while a percentage sign (%) is used with tones which bear an association link to an intonation phrase boundary.

The range of prosodic entities with which tones associate varies across languages (see §1.1, this chapter). The system of diacritics may therefore need to be elaborated as part of the development of the transcription system. This has been the case with the Bininj Gun-wok transcription system. In Chapter 5 of this thesis I argue that transcription of a low tone associated with a Phonological Phrase level boundary requires the use of a ‘p’ subscript diacritic, indicating the association of the low tone to this level of boundary. This ‘p’ diacritic for phonological phrase tones is an innovation first used for the transcription of Bengali intonation (Hayes and Lahiri, 1991).

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21 This diacritic was not used in the original ToBI transcription system (cf. Beckman and Ayers Elam, 1997).
There are some discrepancies in the manner in which tone labels are time-aligned with the F0 trace in many current ToBI models. ToBI uses a ‘starred’ tone (H* or L*) to indicate the association of a tone to a metrically prominent syllable. The starred tone label is time-aligned with any F0 ‘turning point’ or ‘elbow’ within the stressed syllable; if such a turning point falls outside the syllable boundaries, for example, in the preceding or following syllable, a ‘pointer’ label (> or <, respectively) is used to indicate the phonetic location of the tone target. On the other hand, labels for tone targets associated with prosodic boundaries are conventionally time-aligned with those boundaries, rather than the actual location of the target. In the present description, investigation of the alignment of a Low boundary tone was facilitated by the use of a separate Phonetic tone tier, in which the actual alignment of the L tone target was indicated.

1.6.1.3 ToBI and prosodic phonology

The Tones component of a ToBI description annotates the association of tonal events to elements in the prosodic structure of a language. The prosodic structure may not necessarily have been described prior to preliminary tonal transcriptions: determination of the prosodic structure and identification of tonal events may proceed in tandem in a previously undescribed language.

The Break Indices component of ToBI is a measure of perceived prosodic juncture between words and phrases. In the current English ToBI system, four levels of perceived juncture between words and phrases are annotated in the Break Indices component (Beckman and Ayers Elam, 1997):

0  clitic + word boundary, as indicated by the presence of segmental phonetic cues to cliticisation
1  default word juncture
3  intermediate phrase boundary
4  intonation phrase boundary

In contrast to Break Indices 0, 1, 3 and 4, Break Index 2 does not annotate a specific level of perceived juncture in the English ToBI system. It is used by the transcriber to label mismatches between tonal and other perceptual cues to juncture. On the one hand, it may
indicate the presence of pause in conjunction with tonal continuity across a break, and on
the other, rhythmic continuity, where the tonal correlates of the boundary would usually
co-occur with a higher level of juncture.

The percepts of juncture annotated by Break Indices are complex perceptual
integrations of acoustic and structural cues to prosodic units. Structural cues may include
the presence of a culminative or head-marking prominence within the unit (which can
occur at some distance from the boundary of the unit), or the global F0 register of the
unit, if higher or lower than adjacent units. Local acoustic cues may include tonal,
durational or segmental (morphophonemic) correlates of the boundary, located within the
initial or final syllables of the unit.

Break index annotations can provide the initial basis for an acoustic investigation
of cues to prosodic boundaries. In the ideal case, the sources of evidence for prosodic
boundaries will be multiple: local phonological alternations conditioned by the presence
or absence of a boundary (cf. Nespor and Vogel, 1986), as well as tonal and/or durational
cues.

1.6.1.4 ToBI annotation and the phonological status of transcriptions
One criticism that is frequently levelled against the original ToBI system is that it fails to
adequately discriminate phonetic and phonological levels of analysis. Grabe (1998a)
argues: “The exact status of ToBI has remained somewhat vague. Specifically, it is
unclear whether ToBI is intended to provide phonetic transcriptions of intonation,
phonological transcriptions, or possibly neither.” Hirst, di Cristo and Espesser (2000)
claim that ToBI requires “that the inventory of pitch patterns of a given language already
be known before transcriptions can be made”. Neither statement, however, constitutes a
completely valid criticism. The original version of ToBI was intended to transcribe a
specific set of intonation patterns the developers had discovered across the three varieties
of English mentioned above. As such, it was the developers’ intention that the
intonational inventory of the dialects be known, as far as possible, before transcription of
large corpora began. Recent ToBI-style transcription systems for languages other than
English, such as Korean (K-ToBI, Jun 2000), and also the IViE system, have
incorporated a phonetic tone labelling tier in addition to a phonological tier, in order to
overcome phonetic/phonological ambiguities created by the use of a single tier. A phonetic labelling tier was not a systematic part of the development of the BGW-ToBI transcription system. However, a phonetic tier was used in the labelling of low boundary tones, specifically in order to investigate their alignment (see Chapter 5). It is envisaged that a phonetic tier will be used systematically in future transcriptions.

Grabe’s criticism touches on an essential problem of intonational phonology, one which distinguishes it sharply from segmental phonology: the difficulty of establishing criteria for phonological status. As Grabe (2001) comments: “phonological analysis in intonation is difficult and controversial, and there are no widely accepted tests (whether experimental or introspective) for phonological category membership…” While it is possible to criticise the original procedure involved in ToBI labelling – the direct labelling of a supposed phonological level of entities – applying perceptual tests to determine the phonological status of the labelled entities remains a complex task.

A categorical perception paradigm can be used to test the phonological status of segmental phonemic units. The categorical perception paradigm may also be successful in distinguishing intonational categories, in cases where intonational stimuli naturally present a binary dimension of contrast (cf. Remijsen and van Heuven, 1999 (L% vs H%); Pierrehumbert and Steele, 1989 (L*+H vs L+H*)). However, while the categorical perception paradigm can be successfully applied to certain intonational contrasts, the instances in which it is possible to establish such minimal pairs are by far outweighed by those in which the procedure cannot be readily applied.

One particular area of ambiguity is the phonological status of purely ‘structure-marking’ prosodic and intonational entities, and in particular, the status of modifications applied to the realisation (scaling and alignment) of intonational tones (see Ladd, 1996: 279). Modifications noted in the literature to date include varying degrees of higher scaling of high tones (‘pitch reset’ or ‘declination reset’) at the onset of prosodic constituents of various sizes (e.g. Vaissière, 1995; Mithun, 1995; Ladd, 1990); optional lowering of a low boundary used to indicate a phrase is final in a discourse sequence (‘final lowering’) (e.g. Fletcher and Evans, 2000; Prieto, 1998; Swerts, 1994; Wichmann, 1993; Pierrehumbert and Beckman, 1988; Bolinger, 1978); and increasingly late alignment of a high accent-related tone target that is initial in a prosodic constituent,
corresponding to the increasing size of the constituent (Wichmann et al., 2000; Gussenhoven, 2002). In relation to modifications in scaling, Ladd (1996) adopts the quite radical view that “such resettings are simply the phonetic manifestation of phonological pitch range relations that can hold between prosodic constituents at different levels of structure” (see also Ladd and Morton, 1997). That is, the modifications may be gradient in realisation, but, within the particular scaling context of a phrase, will be categorically interpreted as a cue to a structural relationship between this and a preceding or a following phrase. With both final lowering and phrase-initial pitch reset, the greater the modification (the higher the reset or the lower the low boundary), the greater the degree of ‘disjuncture’ likely to be perceived between the preceding or the following phrase.

Despite Ladd’s arguments for the categorical nature of such modifications, they have not yet found a clear place in ToBI-style transcription systems, reflecting the current general uncertainty as to whether they should be treated as linguistic, ‘surface phonological’ categories, or merely paralinguistic effects. The original American English ToBI transcription system does not include any labels for surface phonological derivations from underlying tones. This is because that system derives from Pierrehumbert (1980), in which it was stipulated that the underlying and surface representations – in English – are identical (1980:11):

In other languages [than English] rules which alter tonal values or delete tones can apply to such a [underlying phonological] representation. English appears to lack such rules, with the result that the underlying and derived phonological representations of intonation are identical.

However, in assigning such gradient variation the status of a ‘paralinguistic’ phenomenon, we may be underestimating its importance to communication (cf. Ladd, 1983, 1996: 280-283). In practical terms, it is useful to label accents perceived as emphatic or as fulfilling a demarcative function at the onset of a phrase, in order to be able to examine these phenomena further. These issues will be taken up again in Chapter 5, in relation to modifications in the tonal alignment of accentual high tones in BGW.
1.6.1.5 Annotation of pitch range in ToBI transcription systems

In ToBI transcriptions, a measure of the upper limit of the speaker’s pitch range is sometimes taken by labelling the highest phonologically significant point in (pre-defined) intonation phrases as “HiF0”. The lower threshold of the speaker’s range is measured at points of perceived ‘final lowering’, which typically do not occur at the end of every intonation phrase (cf. Fletcher and Evans 2000). However, it is not clear how or if such statistical reconstructions of highest and lowest mean F0 values are in fact related to the manner in which a hearer is able, very rapidly, to judge a speaker’s pitch range, and thereby assess the location of particular F0 movements in relation to that range; though a hearer may be able to judge the upper and lower limits of a speaker’s voice, for example, by variations in phonation at or close to those limits (Ladd, 1996: 257).

The speaker’s pitch range in a given intonation unit represents a subsection of the speaker’s capacity for pitch variation. The differential between the highest and lowest phonologically relevant points in an intonation unit represents the speaker’s span, or range of F0 variation in the unit (cf. Ladd, 1996: 260). The highest and lowest values also give information as to how high or low the intonation unit is situated within the speaker’s overall pitch range. Span relates to distinct functions of local prominence within the phrase, as distinct from the global prominence of the phrase in relation to neighbouring phrases (= level, or register). For example, the level of a phrase used as an ‘afterthought’ may be substantially lower than that of the preceding phrase, while the level of the first phrase in a quoted utterance may be substantially higher than the phrase introducing it. The original ToBI system does not include any labels for annotating shifts in pitch range and register between phrases (including upward or downward pitch reset at the onset of intonation phrases). In English, the phonological status of register shifts affecting the whole of a phrase remains unclear, though Ladd (1990: 45-46) proposes that metrical relations between phrases are produced by such shifts in register, and may be associated with particular clause relations, such as subordination vs coordination. In other languages, such as Wik-Mungkan, shifts in range and register between phrases may be conventionalised to an extent which clearly requires their inclusion in the annotation system. At this point in time, the uses of pitch range and register variation in BGW have
not been fully explored, and therefore annotations have not yet been developed, though it may prove necessary to do so in the course of future research on the language.

1.6.2 Comparison with INTSINT

INTSINT was developed by Hirst and di Cristo to provide a system for annotating intonation in large speech corpora. The INTSINT annotations are designed to be used in training a speech synthesis system to produce acceptable and appropriate F0 contours in various phonological, syntactic, semantic and discourse-pragmatic contexts. The symbolic representation set therefore has to “be in such a form that it can be used as input to a synthesis system, the acoustic output of which can then be directly compared to the original F0 curve” (Hirst, di Cristo and Espesser, 2000: 58). Additionally – and possibly somewhat at odds with the above goal, which requires a severely constrained annotations set – INTSINT aims to provide

a level of description at which we can describe the prosody of different languages cross-linguistically using a restricted inventory of symbols much in the way that the International Phonetic Alphabet is used to describe the vowels and consonants of different languages (Hirst, di Cristo and Espesser, 2000: 69).

The INTSINT system comprises a set of ‘absolute’ tone labels and a set of ‘relative’ tone labels. The absolute tone labels, Top (T), Bottom (B) and Mid (M), are said to refer to “the speaker’s overall pitch range (at least within the current Intonation Unit)” (p.70)\(^2\). In practice, however, the label M applies at only one target point in the intonation unit: the initial point (Hirst and di Cristo, 1998: 16). The other two labels are used for the initial target point – if it is not M – and one further target point in the unit (the highest, if the initial point is B, and vice versa). Thus, phrase position-specific constraints on the division of the tonal space are assumed, though their cross-linguistic applicability is unclear. The ‘relative’ INTSINT tone labels (Higher, Lower, Same, Upstepped and Downstepped) annotate targets according to their scaling relative to both the preceding and the following target point.

\(^2\) The ambiguity in this statement is problematic: the speaker’s overall pitch range is confounded with the pitch range exercised within a given Intonation Unit (leaving aside how that is defined). In quantitative terms, a speaker’s pitch range is essentially a statistical entity, an average measure of highest and lowest measurable F0 values for a given
A significant problem for the use of INTSINT cross-linguistically is its inexplicitness in relation to the interdependence of prosodic and intonational structure. I believe the important questions in intonational-prosodic typology relate precisely to the nature and forms of this interdependence. INTSINT symbols are a simple phonetic transcription of perceptually salient F0 movements. Although Hirst and di Cristo (1998: 74-77) advocate the association of the INTSINT transcription system with a symbolic (purportedly phonological) representation couched in an autosegmental-metrical framework, the two representation systems are arbitrarily related. In an autosegmental-metrical ToBI-style transcription, the phonetic level of representation is organically related to the phonological, since both are stated in terms of the two level tones, H and L. At the phonetic level, a ToBI transcription is concerned with the scaling and alignment of these tones; at the phonological level, with their relationship to the prosodic structures of the language, a relationship that is efficiently expressed by the use of diacritics relating elements of prosodic structure to tones.

1.6.3 Development of BGW-ToBI

The application of a ToBI-style transcription system to any new language or dialect necessarily involves establishing an inventory developed through the process of transcription. In the case of BGW-ToBI (which I describe in the following section), pilot studies had established that there was a relationship between F0 peaks of varying height and metrically strong syllables, and had also established the existence of high, low and low-rising intonational boundaries, prior to the development of the transcription system as a whole (Fletcher and Evans, 2000). A preliminary inventory of accent types was determined by examining the F0 of stressed syllables, and of the preceding and following syllable, which may carry an F0 target if an accent is bitonal (such as L+H*). The phonological status of the accent types was then tested, by examining the prosodic and phonetic contexts in which the transcribed accent types occurred, as described in Chapter 5.

speaker. Such a measure should be taken across a variety of texts, in a range of discourse contexts: a speaker’s manipulation of pitch range may vary considerably across contexts (cf. Ladd, 1996: 259).
The development of the inventory of boundary tone types took place in conjunction with the labelling of break indices, in line with the assumption that boundary tones associate with specific levels of prosodic phrasing, and that these levels of phrasing are likely to correlate with different degrees of perceived juncture. The postulated levels of juncture were then closely examined in order to establish their acoustic correlates, as described in Chapter 6.

1.7 The BGW-ToBI transcription system

1.7.1 Overview of BGW-ToBI

In this section I outline the BGW transcription conventions adopted in this dissertation. The BGW-ToBI transcription system is closely based on the Tones and Break Indices system developed for General American English (Pitrelli, Beckman and Hirschberg, 1994) and an increasing number of other languages, including Australian English (Fletcher and Harrington, 1996), Korean (Beckman and Jun, 1996), Japanese (Venditti, in press), German (Benzmüller and Grice, 1999; Grice, Baumann and Benzmüller, in press), European Portuguese (Frota, 1998), Greek (Arvaniti and Baltazani, in press), Italian (d’Imperio, 1999) and Chickasaw (Gordon, in press). The transcription system presented in this section differs from Bishop and Fletcher (in press) in one respect only: the L% intonation phrase boundary tone used in the latter system is omitted, as there appears to be no evidence differentiating such a tone from the Lᵢ phonological phrase boundary tone in the data described in this dissertation (refer to Chapter 6 for arguments supporting this position).

All data for this dissertation were labelled using a modified version of the ‘Transcriber’ shell developed for English ToBI. ‘Transcriber’ is an ESPS/Xwaves shell with linked ‘menu’ files for each label field or ‘tier’. Four ‘core’ tiers (word, tone, break indices and miscellaneous) were included in all BGW-ToBI transcriptions. These four tiers are described in sections 1.7.2 to 1.7.5 below. In addition, an optional syllable tier (§1.7.6) was frequently used in the course of this study in order to examine the alignment of tone targets in relation to the segmental structure.

Labelling was carried out using the acoustic waveform, fundamental frequency trace and text label files (see Figure 1.3). In some cases, spectrograms were also
generated along with RMS amplitude traces to facilitate stressed syllable location and word level transcription.

One limitation of Transcriber worth mentioning is that it lacks the functionality to automatically correlate information from the different label tiers. Such functionality would enable the researcher to find, for example, all intonation phrases containing three accented words, or all utterances ending in final lowering. It is envisaged that future work on BGW will be facilitated by the use of EMU, a set of software tools developed by researchers at Macquarie University for the creation, manipulation and analysis of speech databases. The important innovation of these tools is that they allow hierarchical linking of, and searching on, data labels in different tiers.

1.7.2 Word tier

The orthographic word tier in BGW-ToBI is similar to the orthographic tier in other ToBI systems. Words in each dialect are transcribed using the conventional orthography developed by linguists in consultation with communities identifying with that dialect (see Evans: §1.2.6, in press, for further detail on the development of the BGW dialect orthographies). These conventions are outlined in the tables of phonemes and orthographic representations given in the opening pages of the dissertation.

Each word label is linked to the final segment of the word in Transcriber. Spectrograms are used where necessary to facilitate location of these right edges.

Words in the word tier are generally segmented according to their morpheme composition, in order to assist in the determination of metrical structure (see Figure 1.3). A full key to the morphological glosses used in this dissertation is provided in the table of abbreviations and conventions in the opening pages of this dissertation. Morpheme junctures are indicated by a hyphen (-).
Figure 1.3: Text and intonation labelling using time-aligned tiers in Transcriber.

The arrow indicates the word tier with morphological segmentation. The tier above the word tier is the tone tier, the tier below the break index tier. The F0 trace is below the tiers, and the acoustic waveform at the top. The utterance is from Kunwinjku (speaker MM).

Transcription: bene-h-jal-re bi-h-kengem-i bi-widna-ni
Gloss: 3uaP-IMM-just-goPI 3/3hP-IMM-frighten-PI 3/3hP-hate-PI.
Translation: ‘The two of them were just going along together. She was frightened of him [her husband]; she hated him.’

1.7.3 Tone tier

Two basic tone types are included in the labelling conventions for the tone tier – pitch accents and boundary tones. Pitch accents are associated with metrically strong syllables and boundary tones with the right edge of phonological and intonation phrases.

The inventory of tunes in BGW is relatively sparse compared with that of prototypical intonation languages such as Dutch and English. 23 There are five pitch

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23It may be that BGW uses other aspects of the prosody to produce inferential meanings which are created in languages such as Dutch and English by the paradigmatic choice of tune. These aspects might include, for example, phrasing and
accent types, four of which are monotonal (high peak, delayed high peak, lowered (downstepped) high peak and raised (upstepped) high peak) and one bitonal accent (low-rising). There is one type of phonological phrase boundary tone (low), one type of intonation phrase-final boundary tone (high), and two types of intonation phrase-initial boundary tones (high and low). The pitch accent types are outlined in section 1.7.3.1, and the boundary tone types in 1.7.3.2.

1.7.3.1 Types of pitch accents
The following outline is a summary of accent types observed in all dialects of BGW. A detailed analysis of the phonological status and phonetic realisation of pitch accents in the Kuninjku dialect is the subject of Chapter 5.

Simple high

H* This is the main accent type in BGW. H* is realised as a rise, generally from the onset of the accented syllable, to a peak within that syllable. The peak is aligned late in the syllable rhyme unless the accent is preceded by another H* accent, as in a hat pattern. The tone target is generally scaled within the mid-upper part of the speaker’s F0 range.

Simple high with high tone spread within the foot

H*=> This is a relatively infrequent high accent, the phonological status of which remains uncertain. H*=> is realised as a rise from the onset of the accented syllable to a peak within that syllable, followed by high level pitch across the remaining syllable(s) of the foot.

Late peak high

H*< The late peak high accent is realised as a rise from the onset of the accented syllable to a peak in the post-stress syllable. Following the ToBI conventions, the highest F0 point is labelled with an additional diacritic ‘<’ to indicate the actual dephrasing, pitch range modifications, and possibly modifications of tune-text alignment (see Chapter 5 with regard to the latter).
location of the late peak (the angled bracket points back to the stressed syllable with which the peak is phonologically associated). In BGW, it appears that the peak is never delayed beyond the post-stress syllable. As with the simple high accent with high tone spread, the phonological status of the late peak high accent remains uncertain (see Chapter 5, §5.4.8 and 5.5.2).

Simple downstepped

!H* The tone target is lowered relative to a preceding high tone target within the intonation phrase. The preceding H target can be any of the following: a simple H* followed by a fall to a low phonological phrase boundary tone, an H* accent, an L+H* rising accent (described below) or an intonation phrase initial high boundary tone (%H; see §1.7.3.2), which creates a ‘high prehead’ extending up to the first accent in the phrase.

A downstepped accent may be acoustically realised in three ways in the F0 trace: (1) as a short rise to a peak, following the low trough of a preceding low phonological phrase boundary tone\(^{24}\) (as on the word bo-yoy in Figure 1.6; see section 1.7.3 below for a description of the low tone); (2) as a short plateau at the same F0 level as the low target of a preceding low phonological phrase tone (as on the word kanjdji in Figure 1.7); and (3) as a short plateau following a drop from a high F0 level (as in Figures 1.4 and 1.5 below). The last configuration may be found where a period of voicelessness or glottal closure intervenes between the H and !H targets, such that the F0 fall is not apparent in the trace. For example, in Figure 1.4, there is a glottal stop at the end of kunih.

The three downstep contours are illustrated schematically below. These contours are acoustically distinct, but auditorily, the percept of a downstepped accent is similar in each.

\(^{24}\) This analysis incidentally provides a different perspective on the phenomenon of lowered or ‘downstepped’ high pitch accents observed in Fletcher and Evans (2000). In that study, it was noted that a downstepped accent frequently follows a high pitch accent that is “followed by a sharp fall into the mid to low range for the speaker” (35). The high falling accent is analysed as a “‘phonological’ trigger” for downstep, following the analysis of downstep in Pierrehumbert (1980). In the present study, in contrast, the fall is analysed as due to the phonological phrase Lp boundary tone, and the downstep on the following accent reflects the speaker’s choice of a lower register for this next phonological phrase (see Chapter 6, §6.6).

\(^{25}\) Illustrations of the kind shown in Figure 1.4 were produced using the Scicon program Pitchworks on a Macintosh G4 platform. These illustrations show tone, word and other label tiers (as relevant) and three signal windows: an acoustic waveform window, a window showing variation in RMS amplitude (measured in decibels), and at the bottom, a window displaying the fundamental frequency trace (F0, measured in Hertz).
Figure 1.4: Downstepped high accent (!H*) on barri-yimeng. The arrow indicates the downstepped high tone target.

Transcription: kunih barri-yimeng
Gloss: there 3aP-sayPP
Translation: “Just there (in the middle distance)” they said’.

Sound file 1.1
Figure 1.5: Downstepped high accent (H*) on the reduplicant base -bunkurduyh in Kundedjnjenghmi (speaker JK). The arrow indicates the downstepped high tone target.

Gloss: 3-dreaming-standNP [place.name].
Translation: ‘There’s a dreaming at Bunkurduyh-Bunkurduyh.’

Sound file 1.2

Figure 1.6: Downstepped high accent (H*) on bo-yoy. The arrow indicates the downstepped high tone target.

Transcription: ku-wardde ø-bo-yoy
Gloss: LOC-cave 3P-water-liePP.
Translation: ‘Water lay in the cave.’

Sound file 1.3
Simple upstepped

^H*  The upstepped high tone target is raised relative to a preceding high accentual tone target within the intonation phrase. It is aligned in the same manner as H* and !H* (see Figure 1.7, and figures in section 3.12 in Chapter 3).

Figure 1.7:  Upstepped high accent (^H*) on the word kanjdji, ‘underneath’, in Kunjinjku (speaker MK2). The arrow indicates the upstepped high tone target.

Transcription: but nani kanjdji bene-yoy
Gloss:  CONJ MA.DEM. underneath 3uaP-liePP
Translation: ‘but those two, they had lain down underneath …’

Sound file 1.4

Bitonal (low rising)

L+H*  This pitch accent consists of a high tone preceded by a rise from the lower part of a speaker’s pitch range. The rise is generally observed through the stressed syllable, and may begin in the preceding unaccented syllable.

It is necessary to distinguish this bitonal accent from a tonal sequence consisting of an intonation phrase-initial L tone (transcribed %L; see section 1.7.3.2) and followed by H*, a particularly common sequence in the Gun-djeihmi dialect. There are two ways in which L+H* accents can be distinguished from an %L H* sequence. There is usually tight temporal coupling between the low and the high tone in the case of the bitonal L+H* accent. In the case of the %L H* sequence, the L is clearly anchored at the left phrase edge and can occur at some distance from the first H* accent. Phrase- and word-
medial instances of low rising accents provide further evidence for the L+H* accent, since the L tone in these instances cannot be accounted for by a boundary tone associated with a preceding phrase edge (see Figures 3.36 to 3.40 in Chapter 3). The rise in L+H* tends to be somewhat sharp (see Figure 1.3 above) and the H target is generally realised in the upper part of a speaker’s range. However, in a sequence of L+H* tones the second H* may be downstepped, and is labelled L+!H* accordingly (see Figures 3.37, 3.38 and 3.40 in Chapter 3).

L+H* is a much less frequent accent type than H* in BGW. In Gun-djeihmi narratives, the accent is usually employed to signal emphasis or narrow focus (Fletcher and Evans, 1998). It generally sounds more emphatic than a simple H* pitch accent.

A particular use of the L+H* tone in Manyallaluk Mayali is in WH-questions and imperative utterances (see Chapter 3, §3.10 and Chapter 2, §2.4 and 2.5). The phrase-final fall-rise-fall pattern which is associated with these utterances was originally analysed as L* HL%, with the HL% sequences being realised as a rise-fall in the absence of a phonological upstep rule in the language. However, re-analysis of the alignment of the first L tone and the relatively strong auditory prominence26 of the H in the HL sequence indicates an analysis of L+ (!)H* L% is a more appropriate description of the tone pattern and its prosodic structure.

1.7.3.2 Types of boundary tone
One level of boundary tone is presently distinguished for all dialects: the intonation phrase level. In Chapter 6 of this dissertation I will also provide evidence for a tonally marked phonological phrase level prosodic constituent, with data principally drawn from the Kuninjku dialect.

Boundary tones are labelled in the tone tier at the end of the relevant phrase, aligned with the right edge of the final word in the phrase.

One feature of the boundary tone labels in BGW-ToBI is that there is no phonological upstep rule for boundary configurations, in contrast with American and Standard Southern British English, or German (Grice, Baumann and Benzmüller, in

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26 The prominence of this syllable is not readily apparent from the relatively low intensity indicated by the waveform in Figure 2.8. However, as Fant and Kruckenberg (1993) observe, “...the general trend of declination of intensity in the sentence complicate[s] the use of intensity as a stress correlate.”

47
There is no evidence for an H-H% boundary tone sequence, denoting a high-rising tone, but only H%, used in BGW-ToBI to denote a level high boundary, and the sequence Lp H%, used to denote a low-rising boundary. The distribution of low and high boundaries at intonation phrase-level and utterance-level varies considerably across texts. Although low boundaries generally predominate, the percentage of low boundaries across all texts in this corpus varied from 42% to 93%. High boundaries constituted between 7% to 58% of all boundaries, while low rising boundaries were rare, at between 0% and 3% of boundaries.

*Low Phonological Phrase boundary tone*

$L_p$ The phonological phrase boundary tone is realised as a fall from the final high pitch accent in the phonological phrase to a low target aligned with the penultimate or final syllable of the phrase (see Figure 1.8, and Chapter 2, §2.6 for a description of the levels of prosodic constituency in BGW). The phonological phrase is frequently isomorphic with a single morphosyntactic nominal or verbal word, but occasionally extends to two words. Integration of two phonological words in a single phonological phrase is the subject of Chapter 7.

Dips in the pitch trace labelled $L_p$ are not always perceptually very salient. Their salience depends both on the rapidity of the movement and the extent of the fall, and there is gradient variation in both factors. This means that the auditory percept may occasionally be ambiguous as to whether or not there is a low tone present. Although all $L_p$ tone labels were carefully verified for perceptibility, the very care taken may go well beyond the degree of attention an average hearer would pay to the detection of these minor low tone boundaries. In particular, the procedure of isolating the relevant syllable or two containing the fall from the remainder of the word, used in addition to listening to the whole word and whole utterance context of the low tone, clearly increases the analyst’s sensitivity to, and ability to detect, the pitch change. On the other hand, some minor low tone boundaries are produced very clearly, with a sizeable fall. As with any phonological entity, then, there are degrees or a continuum of care the speaker may take to make the entity audible. In relation to tonal boundary events, undershooting (higher scaling) of low tone targets may reflect a lesser concern for their perception. Where the
tonal boundary serves a clear junctural function, however, one would predict clearer tokens of the low tone will be found.

The phonological phrase tone frequently precedes a tonally unmarked intonation phrase boundary (denoted -%). The sequence of low phonological phrase boundary tone and unmarked intonation phrase boundary is therefore labelled \( L_p-% \). See Chapter 6 for arguments against a distinct low intonation phrase boundary tone.

\[
\begin{array}{ccccccc}
\text{tones} & \text{H*} & \text{Lp-%} & \text{H} & \text{Lp} & \text{Hp*} & \text{Lp-%} \\
\text{words} & \text{yimarne} & \text{bi-rrulubom} & \text{la} & \text{djal-durn-} & \text{-di} \\
\text{sylls} & \text{birth} & \text{lu} & \text{-hom} & \text{ki} & \text{djal} & \text{dine} & \text{-di} \\
\text{breaks} & \text{3} & \text{4} & \text{11} & \text{100} & \text{150} & \text{200} & \text{350} & \text{700} & \text{1050} & \text{1400} & \text{1750} & \text{ms} \\
\end{array}
\]

Figure 1.8: Low phonological phrase boundary tone on the syllable \(-\text{bom}\). The arrow indicates the phonetic alignment of the low tone target, which is phonologically associated with the end of the word \text{bi-rrulubom} (refer to Chapter 6).

Transcription: \text{yimarne} \text{bi-rrulubom la ø-djal-durndi}.
Gloss: \text{counterfactual.particle 3/3P-spearPP and 3P-just-returnPP}.
Translation: ‘He should have speared him and just come back.’

\text{Sound file 1.5}

\text{High Intonation Phrase boundary tone}

\( \text{H%} \) This is realised as a sustained high F0 level following the initial accent in the phrase, or, occasionally, a slight and gradual rise from this accent. Further details of this contour and its uses are given in Chapter 2, section 2.3.5. In a sequence of \( \text{H* H%} \), the \( \text{H%} \) is not necessarily realised higher in the speaker’s pitch range than the preceding accent. That is, there is no evidence for an automatic ‘upstep’ rule caused by a sequence of high tones, as in the English ToBI \( \text{H-H%} \) boundary tone sequence. In this respect, the \( \text{H%} \) tone in BGW-ToBI resembles the \( \text{H%} \) boundary tone in Glasgow English ToBI
(Mayo, 1996). H% is a common boundary tone in narratives for all dialects. It is principally found non-finally in descriptions of sequential actions and in the initial phrase of a disjunction; the final boundary tone in such sequences is always L_p or L_p -% (see §2.3.5 and §2.4, Chapter 2).

**Low-Rising Intonation Phrase boundary tone sequence**

\[ L_p \text{ H\%} \]

This boundary configuration phonetically resembles the ‘continuation rise’ of the English ToBI system. It generally involves a rise from the lower part of a speaker’s range to a mid-level range. Both the low and the high target align with the final syllable of the phrase. Further details of this contour and its uses are given in Chapter 2, section 2.3.4.

The corpus contains no examples in which an unaccented word follows a fall to the L_p tone after an accented word, with a final high target aligned at the end of the phrase, i.e. contours with a stretch of low level F0 before the abrupt final rise:

However, the present analysis does predict that such contours should be found, if the L target of the rising boundary sequence is indeed the L_p tone and not, for example, the initial target of a bitonal (‘LH%’) boundary tone.

**High Initial Intonation Phrase boundary tone**

\[ \%H \]

This represents a clear phrase-initial target in the high part of the speaker’s pitch range which is not necessarily associated with a phonologically stressed syllable. \%H extends a level high plateau across any speech material preceding the first pitch accented syllable in the phrase (see Figure 1.9; a low boundary tone ends the intonation phrase preceding the phrase barri-yaw-gurrmeng). The \%H tone, and the phrase-initial low boundary tone (%L) described below, are similar to the ‘pre-heads’ of the British School of intonation. The high initial boundary tone is principally found in the Gundjeihmi, Kundedjnjenghmi and Manyallaluk Mayali dialects. These are dialects which,
unlike the Kuninjku dialect, do not necessarily accent the leftmost foot in the word. See Chapter 3 for details of the differences in accent distribution between the Kuninjku and Manyallaluk Mayali dialects. It is not yet clear what function, if any, is associated with a high initial boundary.

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Figure 1.9: High initial intonation phrase boundary tone (%H) in Manyallaluk Mayali. The arrow indicates the high ‘pre-head’ due to the high initial boundary tone.

Transcription: barri-yaw-gurrmeng wodjbirr
Gloss: 3aP-child-put.downPP smack
Translation: 'They put the child down, smacked it.'

Sound file 1.6

**Initial Low boundary tone**

%L This represents a tone target at the onset of an intonation phrase that is distinctly low in the speaker’s range, as opposed to a default, mid-level onset. This low tone target does not align closely with a following high pitch accent, as the L target does in the bitonal accent (L+H*). When the first word in the phrase is unaccented, %L produces a low ‘pre-head’, a stretch of speech (in Figure 1.10, the word an-gole, ‘spear’), with which a ‘floating’ Low tone target is associated. It is principally found in the Gundjeihmi dialect. As with the high pre-head, it is not yet clear what function, if any, is associated with a low pre-head.
Figure 1.10: Low initial intonation phrase boundary tone (%L) in Gun-djeihmi (speaker TG). The arrow indicates the low ‘pre-head’ due to the low initial boundary tone.

Transcription: an-gole ba-mey
Gloss: III-spear 3P-takePP
Translation: ‘He took a spear.’

1.7.4 Break Indices tier

1.7.4.1 Break Indices in BGW-ToBI

As described in section 1.6.1.3, the break indices tier is used to label perceived degrees of prosodic juncture in ToBI transcription systems. Some levels of prosodic juncture are not tonally marked, and are therefore not captured in the tone tier, but may nonetheless be of relevance to the discourse and grammatical structures of a language. The break indices tier may also be used to index the additional prosodic correlates, such as pause, of boundaries which are tonally marked.

Four break index labels are adopted in the present analysis of Bininj Gun-wok: 0, 1, 3, and 4. Break Index level 2 was used in earlier ToBI transcriptions, including BGW-ToBI, as a ‘mismatch’ index, indicating a lack of correlation between the tonal and other correlates of phrasing. For example, BI 2 was initially used for a juncture with an low tone, but a lesser degree of perceived juncture than expected for an intonation phrase, generally a word-level juncture. In the present description, such junctures are transcribed not as mismatches, but as a recognised level of prosodic juncture, the phonological phrase.
The content of the break index labels for BGW is outlined below. Two of the break index labels map directly to two of the levels of the hierarchy of prosodic constituent structure in BGW: the intonation phrase = BI 3 and the utterance = BI 4 (see Chapter 2, §2.6). BI 1 constitutes a level of juncture which does not directly map to a single level of prosodic constituency, since the phonological word and phonological phrase share the same level of perceived juncture, BI 1.

**Break Index 0**

Break Index 0 is used where segments at a morphosyntactic word boundary are phonetically elided, and/or the position of a word boundary is reanalysed in fast speech. That is, the ‘underlying’ prosodic level of Break Index 0 is the level usually indicated by Break Index 1; it does not mark a separate level in the prosodic structure of BGW. In the corpus used to prepare this dissertation, Break Index 0 does not occur more frequently at some kinds of syntactic juncture than at others; nor are there systematic segmental phonological processes, such as liaison or epenthesis, with which the break index is associated. Therefore, for the purposes of the BGW-ToBI transcription system, Break Index 0 is considered to have the status of a phonetic label in a narrow transcription. In an utterance labelled *ma 0 werd 1*, (gloss: OK.let’s.do.it child), for example, a glottal stop at the end of the *ma* is elided and the word boundary is erased. A less transparent example is *gun-dulk 0 yi-rratj(e) 1* (/gUndUlÚ##jIraIc/, pronounced [gUndUlÚ##kIrIc]), glossed as IV-stick 2-cut(.NP) and meaning ‘You cut a stick’), in which there is both elision of the initial glide /j/ and reanalysis of the word juncture. In the example illustrated in Figure 1.11 below, *ngal(i) 0 (ng)albu*, the final vowel /I/ in the first word and the velar nasal onset of the second are elided.

Break Index 0 is only used where it is not possible to discern the original word boundary. In all other cases, BI 1 or a higher level is preferable. Thus, the frequency of occurrence of Break Index 0 in the present corpus, even in fast speech, is relatively low.
Figure 1.11: Break index 0 (and 1 and 4) in Kunwinjku (speaker MM).

Transcription: bi-bom marrkidj ngali ngalbu daluk
Gloss: 3/3anim.-killNP sorceror DEM.fem. fem.-subord. woman
Translation: ‘The clever man killed her, that woman who was his wife.’

Sound file 1.8

Break Index 1

Break Index 1 is the default level of juncture, marking the minimal degree of juncture between a pair of morphosyntactic words in intonation phrase-medial position. There is a distinct perception of the final and initial segments of the words, but no physical pause. Examples of Break Index 1 are in Figures 1.11 to 1.13.

Break Index 3

Break Index 3 is labelled at the right edge of utterance-non-final intonation phrases (see Figures 1.12 and 1.13). There is at least one strong prominence (a pitch accent) per phrase. Relative prominence relations preceding the juncture, and pitch reset in the following phrase, are important cues to Break Index 3.

Phrase-final lengthening (or ‘virtual pause’) does not occur at intonation phrase level junctures (see Chapter 6, §6.5). Break Index 3 is also not associated with pause (see Chapter 2, §2.6.2.1). Since substantial pausing tends to coincide with the percept of finality, Break Index 4 has been reserved for contours displaying one or both of these cues. Break Index 3 is thus largely defined negatively in relation to Break Index 4, as the absence of pause and a sense of completion.
Figure 1.12: Break indices 1, 3 and 4 in a Manyallaluk Mayali utterance.

Transcription: ga-re ga-ngimen mat.jurn gu-watda nuye
Gloss: 3-goNP 3-enterNP black.nosed.python LOC-cave his
Translation: ‘The black-nosed python goes along, (then) into his hole.

Sound file 1.9

Figure 1.13: Break indices 1, 3 and 4 in a Gun-djeihmi utterance.

Transcription: djama gare ngarri-ni gun-babi
Gloss: NEG maybe 1a-sitNP long.time
Translation: ‘Maybe we won’t stay here long.’

Sound file 1.10
Break Index 4

Break Index 4 is used to mark an utterance-final intonation phrase juncture (see Figures 1.11 to 1.13). This juncture resembles a Break Index 3 juncture tonally and with regard to its prominence features, but has one or two additional features: substantial pause and/or a sense of completion or finality associated with final lowering. Refer to Chapter 6, section 6.4 for an analysis of low boundary tone scaling associated with boundary strength, and final lowering, in Kuninjku.

1.7.4.2 Ratio of words to intonation phrases in BGW

A survey of phrasing across Manyallaluk Mayali, Kune and Kunwinjku texts showed ratios of between 1.5 and 2.1 words per intonation phrase. These ratios reflect the fact that much information in the clause is incorporated into the verb in BGW, reducing the use of free nominal and adverbial words to instances where further specification is required of information that is otherwise simply indexed on the verb. There is therefore a close mapping between a single clause (minimally, a verb with a pronominal prefix and inflectional suffixes) and a single intonation phrase. An examination of two Manyallaluk Mayali narratives showed 91% of clauses in one narrative (thirty-one out of thirty-four clauses) and 86% of clauses in another (sixty-nine out of eighty clauses) map onto single intonation phrases.

1.7.5 Miscellaneous tier

The miscellaneous tier is primarily used to note a variety of disruptions to the speech signal or the pitch trace, such as creak or phrase-final devoicing at low pitch; pitch doubling and halving, and microprosodic perturbations of the trace; disfluencies, hesitations and interruptions or turn-taking by another speaker (who may be identified in the miscellaneous tier for the purpose of discourse study); laughter; and various noises (children, dogs). It may also be used to mark silences (<sil sil>) for the purpose of studying the use of pause, and, where relevant, to indicate a stress or accent that is unusually positioned within the word (e.g. ‘final syllable accented’).
1.7.6 Optional Syllable tier

The syllable tier was found to be invaluable for the study of tonal alignment in relation to syllable structure in the present study (cf. Bishop, Fletcher and Evans, 1999, and Chapters 5 and 6). More generally, a syllable tier may serve as an important aid for research on languages in which the morphological word is regularly polysyllabic. The syllable tier may assist, for example, in determining which morphemes are susceptible to elision, or fusion with neighbouring morphemes, and under what prosodic conditions.

1.8 Conclusion and overview of the dissertation

In this chapter I have defined the intended contribution of this dissertation to the project of intonational-prosodic typology, namely, to add to the growing body of knowledge relating to intonation and prosody in morphologically complex languages, and to contribute to rectifying the under-representation of Australian languages in the area of intonational-prosodic typology. The autosegmental-metrical framework applied in this study, as elaborated in ToBI-style models of prosody and intonation, has been used to describe a large and increasing sample of languages to date, and is therefore well-suited to the presentation of new data for comparative purposes.

This chapter has presented a broad outline of the intonational inventory of BGW as it currently appears and is transcribed used the BGW-ToBI transcription system. This inventory is based on a corpus of predominantly narrative data (as described in Chapter 2, §2.2.3), though the tones and tunes observed in this narrative data are also attested in the smaller corpus of conversational and citation form data (described in Chapter 2, §2.2.1).

The remainder of the dissertation is as follows. Chapter 2 provides an overview of the principal intonational tunes of BGW, illustrated from the six dialects. The prosodic constituent structure of BGW is described in detail, and I provide a sketch of the intonational grammar(s). The corpus of texts analysed in the dissertation, and issues affecting the elicitation and choice of texts and speakers for the study, are also discussed.

Chapter 3 describes the correspondence between metrical and morphological structures in BGW, and analyses the interactions of metrical structure and intonational pitch accent in the Kuninjku and Manyallaluk Mayali dialects. Variations in the surface
rhythmic structure of BGW words indicate that the principal correlate of perceived rhythm is accentual prominence (cf. Bolinger’s notion of “accentual rhythm” (1986: 64)). A qualitative analysis of the distribution of accents demonstrates the presence of distinct default accent assignment rules in Kuninjku and Manyallaluk Mayali.

Chapters 4, 5 and 6 are the principal experimental chapters of the thesis. In Chapter 4, I examine the acoustic correlates, other than F0, of accented, metrically strong syllables in Kuninjku. In Chapter 5, I seek to clarify the phonological vs phonetic status of variations in the peak alignment of high pitch accents, by excluding all phonetic variation that is clearly conditioned by phonetic or prosodic context. I argue that the so-called ‘hat pattern’ (t’Hart et al, 1990) constitutes such a context, in relation to the peak alignment of hat-pattern-final accents. Furthermore, I argue that the phonetic realisation of ‘flat hat’ patterns in the Kuninjku dialect necessitates positing the existence of a tone-spreading mechanism in Kuninjku, in addition to the phonetic interpolation mechanism.

In Chapter 6, I analyse low-falling intonational boundaries in Kuninjku as due to the presence of a low phonological phrase boundary tone. I provide phonetic evidence to support the hypothesis that the low tone is phonologically associated with the phonological phrase boundary, rather than one of two, higher-level prosodic boundaries posited in BGW, the intonation phrase or the utterance. I also describe a process by which two phonological phrases may be integrated, the principal index of integration being the absence of a medial low phonological phrase boundary tone. In Chapter 7, the notion of phonological phrase integration, and the lexical and grammatical conditions under which it occurs, are examined in more detail.

Chapter 8 concludes the dissertation.
Chapter 2

Overview of Bininj Gun-wok intonation and prosody

2.1 Introduction and overview

In this chapter I provide an overview of Bininj Gun-wok intonation contours, illustrated from across the six varieties of BGW. Subsequent chapters will focus specifically on data from the Kuninjku dialect, with supplementary material drawn predominantly from the Manyallaluk Mayali dialect.

The outline of the chapter is as follows. Section 2.2 details the corpus of digitised texts used in the preparation of the dissertation, and discusses the criteria used in recording and selecting texts for analysis. In sections 2.3 to 2.5, I relate the intonation contours observed in the BGW dialects to the traditional categories of sentence modality (declarative, imperative and interrogative), and outline the phonological structure and phonetic realisation of these contours. In section 2.3, I also discuss semantic and pragmatic meanings associated with three relatively ‘marked’ declarative contours, the low-rising contour, the high level contour and the stylised high sustained contour. Contours analogous to the stylised sustained high contour have been observed in other Australian languages; these contours are described in section 2.3.6.3.

Section 2.6 sketches the prosodic constituent hierarchy for BGW, arguments for which will be elaborated in the course of the dissertation.

In section 2.7 I present a preliminary model of the intonational grammar of the Kuninjku dialect. Section 2.8 concludes the chapter.

2.2 Overview of the corpus

2.2.1 Texts and transcriptions

All of the data presented in this chapter were recorded by myself, Nicholas Evans, Murray Garde, Caroline Coleman or Peter Carroll in the course of fieldwork programs (Evans, in press; Garde, in prep.; Carroll, 1995). All Manyallaluk Mayali texts, and one Kunwinjku text (LN) were recorded by the author of this dissertation.

The distribution of texts across the dialects is as follows: Gun-djeihmi (4),
Kundedjnjenghmi (1), Manyallaluk Mayali (8), Kune (1), Kuninjku (6) and Kunwinjku (2).

The text types comprising the corpus are the following; see Table 2.1 below for details of text durations and labelling. Seventeen narrative and expository texts, ranging from 1 to 10 minutes in duration, form the core of the corpus. There is one recording of an elicitation session (KUNKURRNG text) and two short recordings of conversations. One conversation is mostly between two women (KL,LK text) and the other is a telephone conversation between two men (TELEPHONE text). All three texts are in the Kuninjku dialect. Two texts in Manyallaluk Mayali containing interrogative citation forms were recorded from three speakers, MK1, HD and PB (32 questions in total) and imperative citation forms were obtained from one speaker. One conversation is mostly between two women (KL,LK text) and the other is a telephone conversation between two men (TELEPHONE text). All three texts are in the Kuninjku dialect. Two texts in Manyallaluk Mayali containing interrogative citation forms were recorded from three speakers, MK1, HD and PB (32 questions in total) and imperative citation forms were obtained from one speaker.

Of the Gun-djeihmi texts, three narratives were recorded from one male speaker (DK) and the remaining narrative text was produced by another male speaker (TG). The Kundedjnjenghmi narrative was produced by one male speaker (JK). Four narrative/expository texts were spoken by one male speaker of Manyallaluk Mayali (PB). This speaker also recorded sets of interrogative and imperative citation forms, with the remaining set of interrogative citation forms recorded from the two female Manyallaluk Mayali speakers (MK1 and HD). The Kune narrative was obtained from a female speaker (LY), one Kunwinjku narrative from a male speaker (MM), and one expository text from a female speaker (LN). Three Kuninjku narrative texts (BILLABONG, CUCKOO and NAMALADJ) were obtained from a single male speaker (MK2). The speaker also took part in a recorded elicitation session (KUNKURRNG text). No gender-specific prosodic patterns were apparent in the corpus.

Table 2.1 outlines the approximate duration of the principal digitised texts (including text-medial pauses; excluding texts consisting solely of citation forms), and the extent of the intonational transcriptions produced for each text. Intonational and word transcriptions for all Kuninjku, Manyallaluk Mayali, Kune and Kunwinjku texts were produced by the author of this thesis. Word transcriptions of Kuninjku texts were made with the assistance of Murray Garde. Intonational and segmental transcriptions of Gun-Djeihmi and Kundedjnjenghmi texts were carried out by Janet Fletcher in collaboration with Nicholas Evans (cf. Fletcher and Evans, 2000).

---

1 Obtained with the speakers’ consent by Murray Garde.
<table>
<thead>
<tr>
<th>Dialect</th>
<th>Text</th>
<th>Speaker(s)</th>
<th>Approx. duration of digitised text (minutes)</th>
<th>Intonational transcription</th>
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</thead>
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<tr>
<td>KUNINJU</td>
<td>BILLABONG</td>
<td>MK2</td>
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<tr>
<td></td>
<td>CUCKOO</td>
<td>MK2</td>
<td>10</td>
<td>Full</td>
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<td></td>
<td>NAMALADJ</td>
<td>MK2</td>
<td>9</td>
<td>Full</td>
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<td></td>
<td>KUNKURRNG</td>
<td>MK2</td>
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<td>Partial</td>
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<tr>
<td></td>
<td>TELEPHONE</td>
<td>unnamed</td>
<td>1</td>
<td>Full</td>
</tr>
<tr>
<td></td>
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<td>KL, LK</td>
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<td>Partial</td>
</tr>
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<td>MANYALLALUK</td>
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<td>PB</td>
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<td>Full</td>
</tr>
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<td>PBTXT2</td>
<td>PB</td>
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<td>Full</td>
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<td></td>
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<td>PB</td>
<td>2.5</td>
<td>Partial</td>
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<td></td>
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<td>PB</td>
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<td>DAVID2</td>
<td>DK</td>
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<td>DK</td>
<td>1</td>
<td>Partial</td>
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<tr>
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<tr>
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<td>LY</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total: 76 +</td>
<td></td>
</tr>
</tbody>
</table>

Table 2.1: Distribution of texts across dialects, text durations and transcription status
The intonation contours of one elderly female speaker of Manyallaluk Mayali, HD (now deceased), were generally difficult to analyse within the framework elaborated in this dissertation. They frequently consisted of long stretches of high or gradually declining intonation which were not readily segmentable into intonation phrases and accent and boundary tone sequences. Since the remaining texts in the corpus, including those from the other two Manyallaluk Mayali speakers, MK1 and PB, did not show F0 patterns similar to this speaker’s, most of the data from HD was set aside for the purposes of this analysis.

2.2.2 Sociolinguistic variation in the corpus

As described in Chapter 1, one of the principal aims of this dissertation is to construct a tentative intonational inventory and grammar for BGW which are internally consistent, and externally motivated, by dint of reference to the present state of knowledge about the perception, production and phonology of intonation. In my statistical analysis of intonation patterns, presented in Chapters 4 through 6, I have concentrated on texts by a single male speaker of the Kuninjku dialect, MK2. The use of data by one speaker of the dialect has been motivated by two factors: positively, by the size of the corpus of data by this speaker (approx. 27.5 minutes of narrative text); and negatively, by the potential for inter-speaker variation in the phonetic realisation of contours to obscure useful preliminary insights into the phonology of the underlying system. In addition, this concentration on one dialect is motivated by the assumption that intonation within each dialect forms an internally consistent system, with conventionality potentially present both in the phonology and in the phonetics (i.e. systematic phonetic differences in the realisation of phonological categories). Impressionistically, the intonational systems appear to substantially overlap between the dialects of BGW; however, such overlap could not be assumed a priori.

Even the assumption of systematicity within a community of speakers of a single dialect may, however, be questionable in the Australian linguistic context. The sociolinguistic and idiolectal diversity in many, if not most, Australian indigenous communities is extreme. This is so even within speech communities in which a single language, such as BGW, is predominantly spoken. In a community such as Manyallaluk, there are at least two generational layers of sociolinguistic diversity. The main two traditional languages identified with and spoken at Manyallaluk are Dalabon and BGW. The present speakers of BGW in Manyallaluk originally come
from a variety of dialectal backgrounds – Gun-Djeihmi, Kunwinjku, Kune – to mention the few I have attested – and undoubtedly others. One generation back, at least one of the parents of these speakers may not have been a BGW speaker. Evans (forthcoming: v) comments:

… many of the texts and even sentence materials I gathered mixed features from other dialects, which was hardly surprising given that many of my teachers had either started out speaking other dialects and switched to Gun-djeihmi as their life circumstances changed… or else were spending a lot of time talking to Kunwinjku speakers.

From generation to generation, the speech situation is therefore in no way stable or homogeneous, and it is possible that there is considerable interaction between the intonational and prosodic systems of the different dialects, and potentially with those of other languages. There is clear evidence of grammatical influence of the Dalabon and Rembarrnga languages on the Manyallaluk Mayali dialect, at least². However, given how little we presently know of intonation and prosody in any one of the dialect systems, any interaction among the systems is difficult to detect.

2.2.3 Genre and the choice of text materials
The task of constructing an inventory requires a considerable body of intonationally marked-up text. Ideally, this body of text would contain as much variation in intonational contour types as possible. The texts available at the time of intonational labelling were predominantly narrative monologues. Although Ladefoged (1993:3) suggests that the preferable material for studying rhythm and intonation in field situations is spontaneous narrative text, it is possible that narrative texts may not show the full extent of intonational variation: in particular, patterns of intonation proper to dialogue and the pragmatic functions inherent in dialogue may be lacking. Intonational variation in spontaneous dialogue settings therefore remains a subject for future investigation in relation to BGW. Nonetheless, narrative data is greatly preferable to citation form data alone, as the latter do not contain the variation necessary to the construction of even a preliminary intonational inventory.

² Evans refers to the Manyallaluk Mayali dialect as a “koiné”. Grammatically, MM shows evidence of influence from its neighbours Dalabon and Rembarrnga in its expanded use of the “-no” 3rd person possessive suffix, replacing the neuter or vegetable noun-class prefix in certain classes of words (Evans, forthcoming: § 5.5.2.5).
‘Laboratory phonology’ style text reading and elicitation exercises are rarely practicable as ways of producing data in the Australian fieldwork context. Elicitation exercises generally require speakers to be able to focus on and isolate linguistic data as abstract objects of investigation, extracted from immediate context. They may involve speakers having to project a situation which is quite detached from their present situation or experience. While some speakers, particularly younger, linguistically trained and literate speakers, may show some ability at such tasks, the most fluent speakers belong to the older generations, and are generally neither literate nor accustomed to dealing with objectified language samples. In my experience, speakers find tasks involving repetition of language samples odd, and, unless (and even when) placed in the context of a meaningful task, such as creating instructional materials, tedious and boring. The emotional context of the task may affect the naturalness of the intonation produced in it. This said, however, it must be admitted that the task of producing a rich description of intonation patterns and their interaction with stress would be greatly simplified if it were possible to apply a methodology such as that advocated by Everett and Everett (ms), in which the stress and intonation of citation form tokens of words, of all prosodic and grammatical types, are contrasted with the realisations of the same words in increasingly large sentential and discourse contexts.

2.3 Declarative intonation

2.3.1 Hat pattern contours

2.3.1.1 The phonological structure and phonetic realisation of hat pattern contours

The main declarative tune in BGW, as in many languages, is what is known as the ‘hat pattern’ contour (t’Hart, Collier and Cohen, 1990; Cohen and t’Hart, 1967). There are two variants of this contour: the ‘pointed hat’ and the ‘flat hat’ pattern. Hat pattern contours consist of a rise early in the phrase, an optional plateau, and a fall at or near the right edge of the phrase. They are found in all BGW dialects. The initial rise is associated with a high pitch accent target, while the fall typically begins directly after (or at most one syllable after) a second high pitch accent target in the phrase:
Figure 2.1 illustrates the flat hat pattern (across the words *gareh ngarri-yi-rrurndeng*, ‘maybe we’ll come back with (it)’) and simple falling pattern (across the word *djenj*, ‘fish’) in Gun-djeihmi. Figure 2.2 illustrates a flat hat pattern in Manyallaluk Mayali. In BGW, immediately adjacent syllables in a ‘pointed hat’ pattern, which consists only of the rise and the fall, may both be accented (see Chapter 3). In Chapter 5, I examine in detail the phonetic alignment of high pitch accent targets (‘peaks’) in hat pattern and non-hat pattern contours in the Kuninjku dialect.

### 2.3.2 Simple falling contours

#### 2.3.2.1 The phonological structure and phonetic realisation of simple falling contours

Another common declarative tune is the simple falling contour, with a short (or no) initial rise to a single pitch accent target, followed by a fall to a low boundary (see Figure 2.1). The phonological analysis of the low boundary in simple falling and hat pattern contours is the subject of Chapter 6.

When a phrase-initial unaccented word precedes the first accented word in the phrase, in either a hat pattern contour or a simple falling contour, one of two F0 patterns may be observed across the unaccented word. Either the F0 remains mid to low and level, or it carries a ‘transitional’ rise to the initial accent target. It is not clear what, if anything, determines which pattern is used across phrase-initial unaccented words. In Figure 2.1, the initial unaccented modal particle *gareh* carries the transitional rise to the initial accent target, located on the first syllable of the pronominal prefix *(ng)arri*.

---

3 The boxed transcription, as used in this figure and hereafter, is designed to show clearly the phonological associations between tones and words or phrases and the syllables with which the tones are associated. The association line joining an accentual tone and a syllable is unbroken; a broken or dashed line is used to indicate the association of a tone to a prosodic boundary.
Figure 2.1: Flat hat pattern contour (across ngarri-yi-rrurndeng) and simple falling contour (across djenj) in Gun-djeihmi (speaker DK).

Transcription: gareh ngarri-yi-rrurndeng djenj
Gloss: maybe 1a-COM-returnNP fish.
Translation: ‘Maybe we’ll come back with some fish.’

Sound file 2.1

Figure 2.2: Flat hat pattern in Manyallaluk Mayali (speaker PB).

Transcription: gun-marlaworr-dorreng
Gloss: IV-leaf-COM.
Translation: ‘With a leaf.’

Sound file 2.2
2.3.3 ‘Terraced’ downstepping and upstepping contours
Terraced contours consist of a sequence of accents of increasingly low (downstepped) peaks or increasingly high (upstepped) peaks. Terraced downstepping contours occur in many other languages (Ladd, 1996), and are found in all of the BGW dialects. Upstepping contours occur less frequently than downstepping contours in BGW. An upstepping sequence of accents may be followed by a downstepped accent within the same intonation phrase. Both upstepping and downstepping contours are discussed in Chapter 3, section 3.12.

2.3.4 Contours with a low-rising boundary
2.3.4.1 The phonological structure and phonetic realisation of contours with a low-rising boundary
A less common declarative tune consists of a hat pattern or a simple fall with a final rise at the right edge of the contour. Figures 2.3 and 2.4 show contours with low-rising boundaries in the Manyallaluk Mayali and Kune dialects. The rise starts relatively low and ends at a mid to high level in the speaker’s range. The rise begins and ends on the final syllable. The low target immediately precedes the onset of the rise, and is therefore also generally aligned with the final syllable of the phrase.

The F0 range of this low-rising boundary is usually not very large. Note, however, the greater extent of the rise in the Kune example (Figure 2.4), in comparison to the Manyallaluk Mayali example shown in Figure 2.3. The arrow in each figure indicates the location of the low-rise. Since the rise begins from a fairly low level in each of Figures 2.3 and 2.4, it does not appear to be the case that a distinct tune is involved; the sequence of tone targets in each case is a low tone followed by a high. Pragmatically, also, the effect of both rises is similar (see section 2.5 for a discussion of the pragmatics of low rises).

The absence of any evidence for a phonological high-rising boundary tune (of the kind English ToBI annotates H–H%) is a notable feature of the entire BGW corpus. However, as described in section 2.2 above, the corpus is limited in the genres it covers, and it is possible that an increased corpus of non-narrative speech genres (e.g. conversation) would uncover further intonation patterns, which might in turn necessitate an expansion of the tonal inventory established to date.
Figure 2.3: Low-rising boundary in Manyallaluk Mayali dialect.

Transcription: na-mak nungan janay
Gloss: MA-good he sandridge.goanna.
Translation: ‘[But that (other) one], the strong one, sandridge goanna...’

Sound file 2.3

Figure 2.4: Low-rising boundary in Kune dialect.

Transcription: kun-morne rerre yungki laik ø-kurrkurrpmeng
Gloss: IV-shoulder already long.time like 3P-twitch.PP.
Translation: ‘[Later, his father already knew that something had happened to his son] because his shoulder had been twitching.’

Sound file 2.4
2.3.4.2 The pragmatics of contours with a low-rising boundary

All the available examples of the low-rising boundary contour in Kuninjku suggest that it is used as a device for checking the comprehension of the listener, either with regard to the identifiability of a referent or the listener’s understanding of the broader scenario being presented. It quite often co-occurs with the word *yiman*, ‘like, for example’, which is used to introduce illustrative material, either with an accompanying gesture or simply verbally.

The use of the low-rise for checking the comprehension of the listener with regard to the identifiability of a referent is also supported by examples in a Manyallaluk Mayali narrative, PBTXT4, in which it co-occurs with the demonstrative *nawu*. This demonstrative is used to mark a referent as one which the speaker assumes will be identifiable by the hearer (see Chapter 7, §7.3.4.1). Himmelmann (1996) observes that, crosslinguistically, this ‘recognitional’ function of certain demonstratives “invites the hearer to signal the need for further clarification regarding the intended referent or to acknowledge that he or she, in fact, knows what the speaker is talking about.” In BGW, the low-rise is apparently an explicit means of checking the assumption of mutual identifiability.

Figure 2.5 is an utterance at the beginning of a recording in which the speaker, DK (a Gun-Djeihmi dialect speaker), is describing the pattern of his days. “Like today”, he says (*yiman bolkgime*), “Nicholas, me, [names of others]… we’ve come here for fishing (*arri-m-wam wakkidj*)”. The low rising contour in this instance is evidently used to engage the listener’s attention to the narrative the speaker is about to tell.

---

*Translation from Evans (in press).*
The examples in Figures 2.6 and 2.7 are from the Kunwinjku dialect. Figure 2.6 is spoken by LN, who is talking to the author of this dissertation about language learning. The speaker’s use of the $L_p H\%$ tone suggests she was wanting to be certain I had understood the reference of the word *balanda* (white people). The long pause after *balanda* may also be part of that reference checking process, or just a contemplative pause. In Figure 2.7, $L_p H\%$ is used in the context of ensuring the mutual identifiability of a referent, who is referred to first as “the mother-in-law” and then (clarifying further) as “the mother [$L_p H\%$]… of Minaliwo”.

![Sound file 2.5](image)

Figure 2.5: Low rising boundary contour in Gun-Djeihmi: *yiman bolkgime*, ‘like today (for example)’. The arrow indicates the rise.

The examples in Figures 2.6 and 2.7 are from the Kunwinjku dialect. Figure 2.6 is spoken by LN, who is talking to the author of this dissertation about language learning. The speaker’s use of the $L_p H\%$ tone suggests she was wanting to be certain I had understood the reference of the word *balanda* (white people). The long pause after *balanda* may also be part of that reference checking process, or just a contemplative pause. In Figure 2.7, $L_p H\%$ is used in the context of ensuring the mutual identifiability of a referent, who is referred to first as “the mother-in-law” and then (clarifying further) as “the mother [$L_p H\%$]… of Minaliwo”. 

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<td>perturb</td>
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![Waveform and spectrum](image)
Figure 2.6: Low-rising boundary in Kunwinjku (speaker LN). The arrow indicates the rise.

Transcription: yo yikah=wi balanda kabirri-djare
Gloss: yes sometimes= only white.people 3a-desireNP.
Translation: ‘Yes sometimes even white people … want (to learn the language)’.

Sound file 2.6

Figure 2.7: Low-rising boundary in Kunwinjku. The arrow indicates the rise.

Transcription: Na-binkullawa bi-bom, alekke ngal-bininj-kurrng al-bu, ngal-badjan Minaliwo
Gloss: [name] 3/3hP-kill.PP, DEM.fem. II-mother-in-law FEM.REL., II-mother [name].
Translation: Na-binkullawa killed the one who was his mother-in-law. The mother [of his wife] Minaliwo.

Sound file 2.7
Figure 2.8 is from Manyallaluk Mayali (speaker PB). In this example, the speaker is returning to a referent he has mentioned earlier. In this case, the use of $L_p H\%$ coincides with the re-topicalization of the referent, and $L_p H\%$ is used to check the listener has recognized the referent as the one previously mentioned.

Finally, in the utterance illustrated in Figure 2.4 above, the speaker is seeking to check on the listener’s understanding not of a reference, but of a scenario: that in the story she is telling, the twitching in the father’s shoulder tells him that something bad has happened to a close relative. This example also shows the co-occurrence of $L_p H\%$ with illustrative ‘like’, here rendered by the Kriol word ‘laik’ instead of $yiman$.

---

**Figure 2.8:** Low-rising boundary in Manyallaluk Mayali. The arrow indicates the rise.

Transcription: nawu na-gimuk galawan
Gloss: MA.REL MA-big Gould’s goanna
Translation: ‘the one that’s big, Gould’s goanna’

**Sound file 2.8**

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<th>$H^*$</th>
<th>$Lp-H%$</th>
<th>$H^*$</th>
<th>$Lp-H%$</th>
<th>$H^*$</th>
<th>$Lp-H%$</th>
</tr>
</thead>
<tbody>
<tr>
<td>but</td>
<td>nawu</td>
<td>na-gimuk</td>
<td>galawan</td>
<td></td>
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<td>words</td>
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<td>breaks</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
2.3.5 *High level contours*

2.3.5.1 The phonetic realisation of high level contours

The principal characteristic of these contours is that the F0 is phonetically sustained at a high level from the preceding accent up to the phrase boundary (Figures 2.9, 2.10). The preceding accent target typically ‘sets’ the tone scaling for the high level section up to the end of the phrase.

Phrase-initially, there is usually a rise from low or mid-level F0 to the target of the accent, followed by the stretch of high level F0. On occasion, just as in intonation phrases ending in a low boundary, the peak of the initial accent in the phrase is delayed to the post-stress syllable (see Figure 2.9). The fact that the tone level reached at this late target point is then sustained up to the end of the phrase indicates that it is indeed the F0 scaling of the accent target which is maintained up to the boundary.

![Figure 2.9: High level contour, with F0 target at the peak setting the F0 level for the remainder of the phrase (Kunjinjku dialect).](image)

Transcription: bene-yoy
Gloss: 3uaP-lie.PP
Translation: ‘The two of them lay down.’

*Sound file 2.9*
The first accent of the IP following the high level contour may show an upward or downward pitch reset, or it may be scaled at a similar level to the high sustained F0 of the preceding phrase.

2.3.5.2 The phonological structure of high level contours

To account for the sustained high F0 in high level contours, I posit a mechanism of phonetic tone spreading from the preceding accentual tone to an H% intonation phrase boundary tone (refer to Chapter 5, section 5.5, for a detailed description of tone spreading and phonetic interpolation as the two principal mechanisms of phonetic interpretation in BGW contours). The H% tone adopts the same scaling as the preceding stretch of high tone. On present evidence, the hypothesis of tone spreading cannot be empirically differentiated from a hypothesis of tonal interpolation between the two high tones, or, on the other hand, an account in which tone spreads from the accent without the following boundary being tonally defined (i.e. simply -% or 0% (Grabe, 1998a)). However, one difficulty with positing the absence of a tonally defined boundary (instead of H%) is that it would leave the phenomenon of low-rising boundaries unexplained. As described in Chapter 1, section 1.7.3.2, I currently
transcribe the low-rising boundary tone sequence as Lp H%, indicating a combination of the low phonological phrase tone and a high intonation phrase boundary tone.

High tone spreads from the initial accent target across potentially any number of word constituents (see Figure 2.11), but minimally, to the end of a single word. In the context of an intonation phrase or utterance ending in a low boundary, each phonological word would typically end in a phonological phrase Lp boundary tone, unless prosodically integrated with another word. However, there is no surface reflex of Lp tones within high level phrases such as illustrated in Figure 2.11. An analysis of Lp tone deletion in high level phrases is offered in Chapter 6, section 6.7.3.

Figure 2.11: High tone spread from an initial accent target to the end of the utterance.

Transcription: ka-m-kuyin-wam kondanj darnkih
Gloss: 3-hither-almost-go.PP here close
Translation: ‘He approached closely, he almost came here.’

Sound file 2.11

2.3.5.3 A classification of the uses of high level contours
Evans (in press) provides an informal characterisation of the intonational phrasing of a small number of constructions and types of clause linkage in Bininj Gun-wok. For example, he observes that “[c]onjunction translatable by ‘and’ is commonly expressed by simple juxtaposition of the conjuncts under a listing intonation” (§6.3.4). In this section I will characterise this and other uses of the high level contour. The relatively small number of categories into which these uses fall indicates that high level contours are a more marked intonation pattern than the falling contour (ending in Lp-
), which occurs, by default, ‘elsewhere’. In the data to hand, high level contours (without stylised vowel lengthening) are associated with the following semantic and pragmatic contexts: topicalisation; equative constructions; conjunction/uncompleted list or sequence (e.g. of actions); and “iconic” incompleteness (nearly X-ed, almost X-ed), where the use of high level intonation appears iconic to the “suspension” of the action in question.

Pierrehumbert and Hirschberg (1990) interpret the identity (H or L) of intonational boundary tones as having a cohesive role in discourse organisation in English. Drawing on the ‘satisfaction-precedence’ model of discourse intentions developed in Grosz and Sidner (1986), they attribute general attentional functions to the English high and low intonation phrase boundary tones, H% and L%. The high boundary tone, H%, “indicates that [the speaker ] wishes [the hearer] to interpret his/her utterance with particular attention to subsequent utterances”, while the low boundary tone, L%, is used “to convey that [the speaker] wishes [the hearer] to interpret his/her utterance with greater attention to preceding utterances.” (1990:192) The kind of attention required of the hearer depends on the nature of the speech act. For example, a final high tone in a question implicitly requests a hearer to provide a completion for the discourse sequence begun by the speaker. Hobbs (1990) proposes a slight modification to Pierrehumbert and Hirschberg’s interpretations, attributing a positive signalling value to the H boundary tone alone. Thus, H signals incompleteness and coherence with a following segment, but L does not signal completeness or separation. Rather, it conveys neutrality with regard to completion (1990: 322).

In the Kuninjku data, the two boundary tones often do not appear to be as independently chosen as either Hobbs’ or Pierrehumbert and Hirschberg’s interpretations would suggest is the case in English. A high level contour ending in H% does signal incompleteness of various kinds in Bininj Gun-wok declarative utterances. However, no examples of high level contours (without stylised vowel lengthening) have been found to which a low boundary in a subsequent phrase (Lₚ or Lₚ-%) could not be understood as the closing of a sequence, either a temporal (aspectual) sequence, or a typical discourse sequence. Thus, it appears that the function of high level intonation is only interpretable in view of what follows; and what follows is always completed by a low boundary tone. The occurrence of high level intonation is thus in a sense ‘dependent’ on an upcoming low boundary.
Sayers (1976) describes a high boundary tone in Wik-Munkan which similarly carries a “sequential” meaning, and “…is usually used in all but the final clause of a Sequence Sentence. The final clause has a marked drop in pitch…” (Sayers 1976: 47). The same high tone may also be used “within the grammatical clause for serial (coordinate) listing of persons or things (other than the final P[phonological]-clause of a list).” (1976: 48) The high boundary tone in Wik-Munkan occurs only on the final syllable of phrases.

High and low intonational boundary tones do not universally carry connotations of incompletion/forward reference and completion/backward reference respectively. For example, Gordon (in press) claims that typical declarative utterances in Chickasaw are completed with a high boundary tone, not low. Ladd (1996) also provides evidence against the universalist position, most notably from Hungarian yes-no questions, which end in a HL% sequence of tones (1996:115-118), rather than a rise or simple high tone. Nonetheless, the present data does suggest Pierrehumbert and Hirschberg’s generalisations hold quite well for Kuninjku.

Use of high level intonation with topicalised expressions

There is a common narrative device in Bininj Gun-wok known as ‘tail to head linkage’ (Carroll, 1995: 86) whereby an expression is used at the end of an IP and with a low boundary tone, then repeated at the onset of the next IP, with a high intonational boundary tone. Often the repeated expression serves as the argument of a new predication or elaboration, as in the example in Figure 2.12; other times, it serves as the background for subsequent actions in the narration.
Figure 2.12: Use of high level intonation for a topicalised expression.

Transcription: birri-kom-dukkang korroko Aboriginal birri-kom-dukkang
Gloss: 3aP-neck-tie.upPP already Aboriginal.way 3aP-neck-tie.upPP.
Translation: ‘…they’d tied up [the dog’s] neck already, in the Aboriginal way. They’d tie up his neck (text continues: with shells, which made a noise like “lerre lerre lerre”).

Sound file 2.12

Use of high level intonation with equative constructions

Equative constructions can be classified as a type of topic-comment structure in which both the argument and predicate are nominals. In the equative construction in Figure 2.13, the speaker translates the Kunkurrng (mother-in-law register) word yul\(^5\) by bininj, ‘man’. In both the original statement and a repetition immediately after, the word yul is pronounced with high level intonation, after an initial rise to the accent in the first token.

\(^5\) Yul is a borrowing from the Yolngu language, in which it means ‘man’.
Figure 2.13: Use of high level intonation in the first part of an equative construction (two instances).

Transcription: la yul bininj, yul bininj nakkanj
Gloss: and yul man, yul DEM.masc.
Translation: ‘And that word yul means ‘man’. Yul, that (means) man’.

Use of high level intonation to convey conjunction/ in an uncompleted list or sequence of actions

This is one of the prototypical uses of high level intonation in Kuninjku, signalling structural incompleteness of a discourse segment, such as a list or a series of actions. The last item on the list will always carry a final fall to low tone at the IP or utterance boundary (see Figure 2.14).
Use of high level intonation to expression incompleteness ‘iconically’

I use the term ‘iconic incompleteness’ to refer to instances in which the use of phrase-final high level intonation is associated with the suspension or incompletion of an action. In this usage, high level intonation typically co-occurs with the morpheme -kuyin-, meaning ‘nearly’ or ‘almost’ (see Figure 2.11 above, and 2.15, 2.16 below).
Figure 2.15: Use of high level intonation with the morpheme *kuyin*, ‘nearly’.

Transcription: wanjh ø-kuyin-libmeng bonj
Gloss: then 3P-almost-lickPP that.was.it.
Translation: ‘So then he went to lick it – and that was the end of him.’

Sound file 2.15

Figure 2.16: Use of high level intonation with the morpheme *kuyin*, ‘nearly’.

Transcription: birri-kuyin-worhnang
Gloss: 3aP-almost-glimpsePP.
Translation: ‘They had almost glimpsed him [when a dangerous dog appeared].’

Sound file 2.16
2.3.6 Stylised high sustained contours

2.3.6.1 The phonetic realisation of stylised high sustained contours

In the stylised high sustained contour, level mid to high F0 is combined with ‘stylised’ lengthening of the final vowel of one word in the intonation phrase (Figure 2.17; cf. Gussenhoven (1984) and Ladd (1996: 40) on the notion of ‘stylisation’ in intonation). The word affected by vowel lengthening need not be the last in the phrase. For example, in Figure 2.20, the word with vowel lengthening is followed by another accented word within a single intonation phrase. If there is a coda consonant following the syllable nucleus, it is not stretched (see Figure 2.19).

Although stylised vowel lengthening is most frequently realised on the final vowel of verbal words, in cases where a nominal word following a verb forms a tight semantic unit with the verb, the nominal may carry the lengthening (see Figure 2.21). In other instances, a separately phrased nominal word or a demonstrative exhibits the vowel lengthening. When used with a verb, or a verb phrased together with a nominal, stylised vowel lengthening typically conveys durative aspect (ongoing or continuous action). At the same time, it iconically ‘dramatises’ the ongoing nature of the action. When used with a nominal, the stylised high sustained contour dramatises the ‘extent’ of the referent: for example, the amount of a material substance, or the extent of a geographical region.

![Stylised sustained high contour in Kuninjku](image)

**Figure 2.17:** Stylised sustained high contour in Kuninjku.

Transcription: la nungan ø-dingih-di
Gloss: CONJ. he 3P-REDUP.stand
Translation: ‘And as for him, he was standing there…’

*Sound file 2.17*
Carroll (1995: 562) observes the same pattern of lengthening and high sustained intonation in the Kunwinjku dialect. In a brief summary of the major intonational patterns observed in Kunwinjku, Carroll provides the following examples of stylised sustained high contours. Length marks and translations are Carroll’s.

- \( \emptyset \)-ningini:: korroko
  
  Gloss: 3P-REDUP-sit long time.
  Translation: ‘He was sitting for a very long time’

- benewa::m
  
  Gloss: 3uaP-goPP.
  Translation: ‘They went a long way (i.e. a full day’s travel)’

- \( \emptyset \)-nalkbuni:
  
  Gloss: 3P-cryPI.
  Translation: ‘He continued crying…’

- birrihdoweni kukku:
  
  Gloss: 3aP-IMM.diePI water.
  Translation: ‘They were dying of thirst’

2.3.6.2 The phonological structure of stylised high sustained contours
I analyse the sustained high F0 and vowel lengthening in the contours described above in terms of a ‘prosodic morpheme’, denoted H::, which associates with the final vowel of the relevant word.

Despite the frequent co-occurrence of stylised vowel lengthening with a high intonational boundary (H%), the high F0 associated with the lengthened syllable is independent of the tonal specification of the upcoming phrase boundary. In Figure 2.18, for example, a low intonational boundary follows the high stretch of F0 from the preceding accent up to the lengthened vowel. This low boundary tone is mostly realised on the /ŋ/ segment remaining at the end of the phrase. The audible portion of the fall also occupies approximately the duration of a single vowel (76ms), at the end of the lengthened vowel, in addition to the coda ng.
In this utterance, the final fall alone conveys the completion of the action described by the verb. The tonal sequence (H...L) in this example carries the very same sense of an action that is incomplete (in this case, the act of looking around) and then finished, as when the sequence is constituted by two full intonation phrase boundaries (...H% ...Lp-%). This incidentally lends support to Gussenhoven’s (1984) contention that particular tone sequences have a status in the tonal phonology which is independent of prosodic constituency, though what kind of status, precisely, is unclear.

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Figure 2.18: Stylised sustained high contour with final fall. An arrow indicates the onset and end of the section of sustained high intonation.

Transcription: ø-djal-nanganang
Gloss: 3P-just-REDUP-seePP.
Translation: ‘He just watched and watched… (and then stopped)’.

Sound file 2.18

As in the plain high level contours, the high tone of the word-initial accent in stylised high sustained contours phonetically spreads up to the following tonal specification. In the case of plain high level contours, the following tone is the high intonational boundary tone, H%. In the case of stylised high contours, it is the prosodic morpheme, H::; The H tone of the H:: morpheme adopts the same tone scaling as the preceding H* tone, producing a stretch of high level F0.
As mentioned above, the prosodic morpheme H:: on verbs typically encodes a sense of durative/progressive aspect, regardless of the tense-aspect marking on the verb. For example, the verb *rawoyh-wa:::m*, glossed as ‘3P-again-go.PP’, is conjugated for past tense (Figure 2.19). Without the sustained high F0 and vowel lengthening, it would be interpreted with perfective aspect (‘he went again’, or ‘he left again’). With only high level intonation, and no lengthening, it might be interpreted as one action in a sequence of actions (but not the last). The vowel lengthening dramatises the action, which is presented to the hearer as though it was currently underway.

![Figure 2.19: Stylised sustained high contour in Kuninjku. The arrow indicates the section of stylised sustained high F0.](image)

**Transcription:** ø-rawoyh-wam ø-nang kabene-rawoyh-bo-rrong
**Gloss:** 3P-again-goPP 3P-seePP 3ua-again-water-strikeNP
**Translation:** ‘He went on again…and saw the two of them clapping on the water’

Since vowel lengthening does not co-occur with low tone, and high level tone alone does not give the same durative interpretation, the sense of durative aspect appears to be due to the *combination* of vowel lengthening with high level tone. A phrase with high level tone, but without stylised lengthening, does not convey durative aspect on the verb. The fact that the combination of high tone and stylised vowel lengthening is interpreted in a unitary manner (together encoding an aspectual distinction) is captured by their representation as a single prosodic morphemic unit (H::).
In Figures 2.20 and 2.21, the word with final vowel lengthening is followed by another accented word within the IP, which in turn is followed by a low intonational boundary (Lp-%). The ‘scope’ of stylised high intonation depends on the scope of the associated meaning. In Figure 2.20, *kuni:: nga-mang*, ‘all over there, I gather it’ it is the extent of the region (in which a certain food or material is collected) which is dramatised by the vowel lengthening associated with the middle distance demonstrative, *kuni*. If the vowel lengthening was associated with *nga-mang*, the meaning would be quite different: the vowel lengthening would dramatise the extension in time of the gathering action itself, rather than the extent of the region in which it takes place.

In Figure 2.21, the nominal adjunct *an-but-but*, ‘(with) kurrajong bark string’ carries the vowel lengthening, rather than the verb *barri-gep-dukgani*, ‘they used to tie up its jaws’. It appears that the vowel lengthening must affect the final word of the semantic unit intended to fall under the ‘scope’ of the meaning associated with H::.
The lengthening affects the final vowel of the whole semantic unit, ‘they used to tie up its jaws with kurrajong bark string’, and dramatises the duration of the tying action. Carroll (1995) cites an example in Kunwinjku, birrihdowni kuku:, ‘they were dying of thirst’, an idiomatic expression in which the verb ‘they were dying’ is followed by the noun ‘water’, which, being the end of the semantic unit, carries the vowel lengthening.

In summary, these three examples indicate that the location of the prosodic morpheme and the associated vowel lengthening is semantically conditioned in BGW (the prosodic morpheme associates with the final syllable of the relevant semantic unit), rather than prosodically conditioned (e.g., the prosodic morpheme associates with the final syllable of an IP).

<table>
<thead>
<tr>
<th>tones</th>
<th>H*</th>
<th>Lp</th>
<th>H*</th>
<th>H:</th>
<th>!H*</th>
<th>Lp-%</th>
</tr>
</thead>
<tbody>
<tr>
<td>words</td>
<td>barri-gep-dukgan-i an-but-but wanyh</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sylls</td>
<td>bu: bu::t wanyh</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>breaks</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
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</tbody>
</table>

Figure 2.21: Stylised sustained high contour with final fall in Manyallaluk Mayali (speaker PB), across the nominal word an-but-but, ‘kurrajong tree sp.’, followed by discourse interjection wanyh.

Transcription: barri-gep-dukgan-i an-butbut wanjh
Gloss: 3aP-jaw-tie.upPI III-kurrajong,bark then.
Translation: Then they tied its jaws up with string made from kurrajong bark.

The prosodic morpheme analysis offered here is not without negative aspects. The use of H:: entails a certain amount of empirical unverifiability: where H:: is combined with H%, the H tone is not phonetically distinguishable in target level from the
An important aspect of the stylised sustained high contour in BGW is that, although the extent of the vowel lengthening is gradient, the hearer must interpret categorically whether or not intentional vowel lengthening is present: that is, whether the speaker intends to convey durative aspect or not. While there is clear iconicity between the extent of the vowel lengthening and the implied duration of the described action or state, this iconicity is only apparent if the primary, categorical, intent to convey durative aspect has been established. There may of course be a degree of ambiguity in the interpretation, and that ambiguity may be related to the gradience of the signal: that is, there may be a point at which it becomes unclear whether intentional lengthening is present or not. However, neither ambiguity of categorisation nor gradience of realisation entail a lack of categoriality.

The distinction in aspect between, for example, the verb *rawoyh-wam* without stylised high sustained intonation (perfective aspect), and with that intonation (durative/progressive aspect), seems indubitably semantic. There are no other indicators of durative/progressive aspect in that utterance, either morphological or lexical (including the quantificational prefix *rawoyh*), which might account for this aspectual interpretation of *rawoyh-wam*.

Woodbury (1987: 685) proposes that in Central Alaskan Yupik Eskimo (CAY), “optional rules of postlexical phonology can make modifications of sound structure which bear non-iconic, conventionally associated meaning”. He argues that the existence of these rules challenges the modularity of the phonological and semantic/pragmatic elements of the grammar. Modularity predicts that there should be such interaction between the postlexical phonology and conventional meaning.

One of the rules Woodbury cites is a rule of ‘foot stretching’, which lengthens and raises the pitch of a foot-final segment (nucleus or coda consonant). The process

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6 Intonation may bear a greater functional load in expressing durativity in the Kuninjku and Kune dialects than in the other dialects of BGW, since these two dialects have no past imperfective conjugation (Nicholas Evans, pers.comm.; see also Evans, in press: 9.3.4.1)

7 Kuiper (1989), in a critique of Woodbury (1987), claims that the double articulation of phonology and the meaning component of grammar would only be challenged if a relationship were shown between semantic content and postlexical phonological elements, not by a relationship between pragmatic meaning and the postlexical phonology. He argues that the CAY examples Woodbury cites only relate to pragmatic and not semantic types of meaning. The BGW data presented in this section, which relate a postlexical prosodic morpheme, H::, to a semantic aspectual distinction, are the kind Kuiper believes should not occur.
may affect only the initial (leftmost) foot in the intonation phrase, or it may also affect subsequent feet. Though the domain and intonational position of the effect differ from Bininj Gun-wok, the iconic content overlaps: as in BGW, “the degree of stretching… is entirely up to the speaker” and as the formal effect increases in magnitude, “the intensification which it signals also increases” (Woodbury 1987: 716). However, in CAY the device also typically “underscores the surprise value” of the information, which it does not do in BGW. In BGW, stylised high intonation more often serves as a means of “setting the scene”, or dramatising a continuous, but backgrounded action, which is then punctuated by a momentary action or event.

Although the degree of vowel lengthening in stylised sustained high intonation in BGW is iconic (greater lengthening = greater extent or duration), the durative/progressive aspect itself is a meaning conventionally associated with the prosodic morpheme H::.

2.3.6.3 Stylised high sustained contours in other Australian languages
A combination of lengthening and sustained high pitch used as an aspectual device (conveying durative/progressive aspect) is widely attested across Australian languages, including languages which are typologically very different and areally distant from Bininj Gun-wok. For example, a contour of apparently similar form and function to that in BGW has been attested in Warumungu and Warlpiri, both Pama-Nyungan languages of central Australia. In this section, I present observations from a range of Australian languages, regarding contours which are more or less analogous to those found in BGW.

*Mangarayi (Merlan, 1982) and Ngalakgan (Baker, 1999)*

Merlan recorded Mangarayi (also spelled Mangarrayi) at Jemberē, a community not far from Mataranka in the western Roper River region. The traditional area for Mangarayi speakers adjoins the area with which Jawoyn is traditionally associated. Alpher, Evans and Harvey (forthcoming) argue that Mangarayi may belong to the same Gunwinjguan language subgrouping as the one which includes Jawoyn, Bininj Gun-wok, Dalabon and Ngalakgan.

Merlan refers to a stylised sustained high contour which is quite clearly analogous to

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8 Jane Simpson, pers. comm.
that used in BGW. She claims that this contour is found in a broad region which encompasses areas in which BGW is presently spoken (e.g. Manyallaluk) (1982: 202):

An extremely common narrative device, used everywhere in the Roper/Katherine area, is that of holding the pitch of a vowel high and constant over several seconds to express continuity of action and/or great distance. Intensity may dwindle towards the end, and the quality of the vowel may be varied somewhat over the several seconds:

ø-ya::::::::j
3sg-go-PP
‘he went’ (a long way, for a long time)

Sometimes when the immediately following utterance expresses an outcome or conclusion to the narrated event, it is uttered at greatly lowered pitch.

Baker (1999:16, footnote 12) also observes the use of a stylised high monotone in Ngalakgan, another language spoken in the Roper River region: “a common discourse device in this area is to lengthen the last vowel of a verb, to indicate temporal or spatial extension or duration: [yir, buippuiy’ne::n] /yir-puyppuy+ne+n/ [sic.] (1aS-singe+[burn+]PP) ‘we singed it (for a long time)’.”

Nunggubuyu (Heath, 1984)

Heath recorded Nunggubuyu speakers at the Numbulwar Mission, on the coast of Arnhem land opposite Groote Eylandt (Heath, 1984:1). He refers to a high level contour found in Nunggubuyu as “narrative high monotone”, noting the possibility of “stylistic” lengthening of the phrase-final syllable (1984: 602):

Narrative high monotone (HM) is characterised by a steady high pitch, little pitch variation from one syllable to the next, and (usually) a similar uniformity in surface duration of syllables except for possible stylistic lengthening of one syllable (usually the final syllable of the string).

Heath characterises HM intonation as “non-foregrounded strings which typically serve to frame a following, more foregrounded string” (1984: 602). In conjunction with stylised final syllable lengthening, HM intonation may be used on a verb with or without reduplication (independently indicating continuous aspect), followed by a ‘completive’ fall to low tone (Heath, 1984: 428):

One very common sequence is the following: [Verb1] [Rdp-Verb1::: n+a] [Verb2]…
An event represented by Verb1 is introduced, usually in unreduplicated form, either punctual or continuous aspect. After a pause, prolongation of this event (or situation)
is indicated by a reduplicated (hence also continuous aspect) form of the same verb with stylistic lengthening of the final syllable. This verb is followed in the same breath group by /nŋa/ [a clause connective]… The reduplicated verb… is often pronounced with continuous high pitch, with pitch falling to low on /nŋa/…

_Alawa (Sharpe, 1972)_

Alawa was recorded by Sharpe in the vicinity of Nutwood Downs and Hodgson Downs, south of the Roper River in the Northern Territory. Her grammar devotes a chapter to intonation, analysed in a tagmemic/stratificational grammar framework (based on Pike, 1967 and Lamb, 1966). Her analyses of pitch and loudness used curves obtained from a Mingograph, and her chapter is therefore one of the first instrumental studies of intonation in an Australian language.

Sharpe (1972: 14) describes a contour she refers to as the “continuous action” and “prolonged action” contour, which is

… manifested by a rise in pitch with strongly syllable timed rhythm, culminating in the lengthening of one syllable of a word for a varying length of time (sometimes the interval is as short as two normal syllables, sometimes it is at least as long as a normal phrase).

Typically the lengthened syllable occurs on an auxiliary verb, and the contour frequently co-occurs with a continuous aspect morpheme. Sharpe observes that “[falling] intonation also occurs on any single word following a continuous action pattern phrase-finally.” (1972: 36)

_Alyawarra (Yallop, 1977)_

Yallop recorded Alyawarra at the Lake Nash community, in the region of the Sandover River, close to the border of Queensland and the Northern Territory. Alyawarra is an Arandic language and therefore very distant, both areally and typologically, from the languages of the Katherine/Roper River Region (BGW, Mangarayi, Alawa) or the coastal region of Arnhem Land (Nunggubuyu). Alyawarra also has a stylised high contour, albeit with certain differences in realisation from the level high contours of BGW.

Yallop refers to the pattern as “sustained level pitch” and describes it as follows (1977: 37):

When word-final a is replaced by iy, the vowel may be considerably lengthened and said with high level pitch. Preceding syllables rise up to the high level. The function is quite specific, indicating extended duration of an action.
Yallop indicates lengthening on both segments of the diphthong by length marks over the final iy; in the illustrations below, this notation is replaced by ::. The illustrations are otherwise a close reproduction of Yallop’s representations. The ‘turning point’ of the rise and fall in each example on the left-hand side corresponds to the stressed syllable. According to Yallop’s (impressionistic) description, “A stressed syllable is made more prominent than surrounding syllables by a variety of variables of which the most important are relative pitch and relative loudness.” (1977: 35) From this it is reasonable to infer that Alyawarra has a stress-accent system. Interestingly, as the second example in the right-hand column shows, the association of pitch prominence (the highest point of pitch) with the stressed syllable is in fact not respected in the contour with sustained level pitch. Rather, the pitch rises steadily up to the onset of the final diphthong, remaining high from that point onward. (In BGW stylised and plain high level contours, the association of pitch prominence with stressed syllables is also generally neutralised after the initial accent, since the stressed syllable is no higher in pitch than any other point in the phrase).

\[
\begin{align*}
\text{alhika} & \quad \text{alhiki::y::} \\
\text{went} & \quad \text{went on and on}
\end{align*}
\]

\[
\begin{align*}
\text{alhikanima} & \quad \text{alhikanimi::y::} \\
\text{then went} & \quad \text{then went on and on}
\end{align*}
\]

\[
\begin{align*}
\text{anina} & \quad \text{anini::y::} \\
\text{was/were staying} & \quad \text{stayed and stayed and stayed}
\end{align*}
\]
Sayers (1976: 60-61) describes a contour which is very similar in form and function (in terms of conveying durative aspect) to that found in BGW, despite the very large areal and typological distance between the two languages (see Chapter 1, section 1.3.1):

The pattern \( \uparrow \ldots -\dddot{\text{a}}:: \) occurs P-sentence-medial and indicates that the action described took considerable time. The clitic \(-\dddot{\text{a}}::\) is long and loud and has high pitch. It lacks descrescendo and may be laryngealised. The relative length of the action is shown by the relative length of the “intonation-carrying” clitic. (Reduplication of the verb stem usually co-occurs indicating continuous action.) The general pitch level of the P-clause is elevated and the pitch range is compressed. [...] the final P-clause, which indicates the final action, has a drop in pitch to the intonation pattern \( \downarrow \ldots -\#^1 \) [low final pitch, neutral pitch range - JB].

Sayers gives the following examples of this pattern (Sayers, 1976: 61). The transcriptions and translations of examples are as provided by Sayers (1976: ii). The diacritics are as follows: \( ^{00} = \) phonological sentence stress, \( ^0 = \) phonological clause stress, \( ^\prime = \) “primary word stress” and \( ^\prime\prime = \) “secondary word stress”, and “int” = intonational clitic, \( ^/ = \) neutral pitch level and neutral pitch range, \( \uparrow = \) elevated pitch level and neutral range, and \( \downarrow = \) lowered pitch level and neutral range.

\[
\begin{align*}
\uparrow^{00} & \, k\, \text{á}l\, -\, k\, \text{á}\, \text{l}\, \text{i}n\, -\, \dddot{\text{a}}:: & \downarrow^0 & \, \text{á}\, \text{k} & /\, \text{ú}\, \text{w}\, \text{i}\, \text{n}\, -\, -\#^1 \\
\text{Gloss:} & \text{they:rowed:and:rowed-int} & \text{place} & \text{they:found-int} & \\
\text{Translation:} & \text{‘They rowed and rowed and then they found the place’} \\
\uparrow^{00} & /\, \text{i}\, :\, \text{y}\, - & /\, \text{i}\, :\, \text{y}\, \text{a}\, \text{n}\, -\, -\dddot{\text{a}}:: & \downarrow^0 & \, /\, \text{i}\, \eta & \text{wámpa\, \text{n}\, -\, -\#^1} \\
\text{Gloss:} & \text{I:went:and:went-int} & \text{here:to:stay} & \text{I:came-int} & \\
\text{Translation:} & \text{‘I went on and on, and then I came to stay here.’} 
\end{align*}
\]

This use of stylised high intonation is strikingly similar to that found in BGW, even to the extent that it is frequently ‘completed’ by a phrase describing a subsequent punctual event and ending in low pitch.

Iwaidja (Birch, 1999)

Birch (1999) describes stylised sustained high intonation patterns directly analogous to those found in BGW. Sustained high F0 and final vowel lengthening may occur on a verb followed by a fall across a completive particle; the vowel
lengthening can also occur on an adjunct or an object following the verb. Figure 2.22 illustrates the use of the completive particle *girrg* with preceding stylised high intonation, where “…the plateau phrase corresponds to the process… whilst the declarative *girrg* signals its end point.” (Birch, 1999: 15; original emphasis) The low boundary following *girrg* is obscured by loss of tracking in the F0 trace in Figure 2.22, but is clearly audible in the sound file.

In a verb-object sequence *ngarrudaga murr*ga:*j* *girrg* (glossed as 1plA.3sgO.stab fat.CONT all, translated ‘(We keep) getting out the fat parts…till it’s all done’), final vowel lengthening affects the following object *murr*ga:*j*, rather than the verb.

![Figure 2.22: Stylised high intonation followed by a low fall across completive particle *girrg* in Iwaidja. (The final fall is not present in the F0 trace due to creak in the final syllable, but is auditorily clearly present.)(Sound file 2.22)](image)

If the following object is a demonstrative phrase, the vowel lengthening affects the nominal word: e.g. *bartamang ba ldungu:*n (glossed as 3p=it-follow that long=yam, translated ‘they follow that long yam’) (Pym and Larrimore, 1979: 224). The phrase directly following the latter phrase is completive in sense and intonation, ending in a low fall: *buwiliman ba gijalg* (3p=it-take that fruit) ‘they get that fruit’.

Regular contact between Iwaidja speakers and Bininj Gun-wok speakers dates back at least as early as the 1920’s; Kunwinjku speakers currently form the second-largest language group on Croker Island, and there are communities and outstations in Arnhem Land (e.g. Jabiru, Cannon Hill) whose members speak both languages. The
text from which the above examples are drawn was recorded in 1967. It is possible, in this instance, that the grammar of vowel lengthening and sustained high intonation used for continuative aspect has been borrowed from one or the other language group. Without a complete mapping of the uses of the stylised sustained high contour in each, however, it is impossible to judge how or in what direction such borrowing may have proceeded.

2.3.6.4 Intensificatory phonetic lengthening of the penultimate vowel in Kunwinjku and Kuninjku

There is another process of vowel lengthening found in BGW, distinct from stylised sustained high intonation, observed by Carroll (1995) in Kunwinjku. This is a pattern of penultimate vowel lengthening, where the lengthened syllable may be, but is not always, the stressed syllable. For instance, in birriwern, ‘a large number of people’, the first syllable would be expected to carry stress (see Chapter 3). However, it is the second syllable which is lengthened.

In each of the available examples of this pattern (listed below), the relevant reading is an intensification of the semantic content of the word in which the lengthening occurs. More data are needed to examine the generality of this phenomenon in BGW. Only one example occurs in the Kuninjku corpus: nungan da::rnkih, ‘he (was) really close’. The pattern appears to be similar to intensificatory vowel lengthening in English, as in: “The balloon was hu:::ge’. In English, too, the location of intensificatory lengthening is quite constrained – phonologically, it must be an accented syllable, with a phonetically long vowel, and syntactically, the word it affects is typically a specifier (Kuiper, 1989). The length transcriptions and translations given below are Carroll’s (1995: 562).

• birri::wern
  Gloss: 3a-many
  Translation: ‘A large number of people.’

• ngalih dja::rre
  Gloss: FEM.DEM. far
  Translation: ‘[This rainbow was] a long way away.’

---

9 In relation to lexical loans between the languages, Evans (in press, §1.3.2) notes that there have been “large numbers in both directions”.

95
• ø-wam ku::ri
  Gloss: 3P-goPP. LOC.DEM.
  Translation: ‘He went a long way in this direction.’

• nungan da::rnkih
  Gloss: he close
  Translation: ‘He (was) really close.’

### 2.4 Interrogative intonation

The corpus contains thirty-two WH-questions elicited from three speakers of Manyallaluk Mayali (PB, MK1 and HD), and a smaller set of WH- and polar questions in Kuninjku, recorded in the course of a Kuninjku elicitation session about the mother-in-law language, Kun-Kurrng, in which a small amount of conversation is interspersed (KUNKURRNG text, speaker MK2).

Unusually from a cross-linguistic perspective\(^\text{10}\), all of the polar questions recorded display a phrase-final fall (Figure 2.14). The tune most frequently associated with the WH-interrogatives in Manyallaluk Mayali is a high pitch accent peak on the phrase-initial WH-question word itself or a demonstrative adjacent to it\(^\text{11}\), followed by a phrase-final fall-rise-fall pattern (Bishop, 1999b; and Chapter 3, section 3.10). The fall-rise-fall section of the WH-question pattern aligns with either the final syllable or the penultimate syllable of the phrase. The final syllable of the word, which is almost always unaccented, bears an accent in this tune (see section 3.10 in Chapter 3 for discussion of this point).

In contrast with the final fall-rise-fall pattern observed with most of the Manyallaluk Mayali WH-questions, two WH-questions from Kuninjku show a simple falling contour (Figures 2.25 and 2.26). As in the Manyallaluk Mayali contours, the strongest accentual prominence in these contours falls on the question word. It may be that the fall-rise-fall contour is only used for WH-questions in Manyallaluk Mayali; or that speakers associate different question contours with different pragmatic contexts in which questions are used. More data is needed in order to determine the extent of variation in contours associated with WH-questions across the dialects.

---

\(^\text{10}\) Though there are notable exceptions: Romanian and Greek, for example, have a final rise-fall in polar questions (Ladd, 1996: 212-214).

\(^\text{11}\) Accentuation of the WH-word in WH-questions is one dimension of crosslinguistic variation in intonational typology which has attracted some attention: Fitzpatrick (2000) for example mentions that “English wh-questions typically do not accent the wh-word, while Bengali (with wh- in situ) and Romanian (with wh-movement) do.”
Figure 2.23: Polar question contour in Kuninjku (with final emphatic accent) (speaker MK2).

Transcription: ngudda=kke
Gloss: you=yours
Translation: ‘It's YOURS?’

Sound file 2.23

Figure 2.24: WH-question contour in Manyallaluk Mayali

Translation: ‘“What are you looking for?” like that. Like, “What are you looking for?”’

Sound file 2.24
Figure 2.25: WH-question contour in Kuninjku (speaker MK).

Transcription: nakka na-ngale
Translation: ‘Who is that?’

Sound file 2.25

Figure 2.26: WH-question contour in Kuninjku (TELEPHONE text, unidentified speaker).

Transcription: nungka bale wam
Gloss: he where 3P-goPP.
Translation: ‘Where did he go?’

Sound file 2.26
2.5 Imperative intonation

The set of imperative utterances in the corpus is small (five), and all were elicited, from a Manyallaluk Mayali speaker (PB). They generally show a very similar fall-rise-fall pattern on the intonational phrase-final syllable to the interrogative utterances.

Figure 2.27: Imperative contour in Manyallaluk Mayali.

Transcription: gan-wo
Gloss: 2/1-giveIMPER.
Translation: ‘Give it to me!’

Sound file 2.27
2.6 The prosodic constituent hierarchy in Bininj Gun-wok

2.6.1 The prosodic constituent hierarchy and correlates of the levels of constituency
The following prosodic structure constituents above the level of the syllable are posited for BGW: the foot, the phonological word, the phonological phrase, the intonation phrase and the utterance. Figure 2.28 represents these five prosodic constituent levels, across the Kunwinju utterance yikah-wi balanda, ‘sometimes even white people’ by speaker LN (see Figure 2.6 above for the F0 trace for the utterance):

```
Utterance
   IP
   PhonP
   PhonWd
   Ft yikah- wi Ft
   Lp H%
   !H*
```

Figure 2.28: Prosodic constituent hierarchy and associated intonational events in a Kunwinjku utterance.

Transcription: yikah-wi balanda
Gloss: sometimes-even white.people.
Translation: ‘Sometime even white people [want to learn Kunwinjku]’

The foot is left-headed and unbounded\textsuperscript{12} in all the BGW dialects (Bishop 2001, 2002; see Chapter 3 for argumentation relating to this analysis). Metrical structure is assigned on the basis of morphological structure; morphemes are generally isomorphic with feet. The principal exceptions are a small set of morphemes which conjugate together with the root for tense, mood and aspect, and prosodically cohere with the root to form a single foot. Evidence for the unboundedness of feet comes

\textsuperscript{12} The use of this term is not intended to imply that feet can be of any length in BGW: feet are rarely longer than four syllables. It is intended to convey the fact that there is apparently no phonological constraint on foot size in BGW, such as foot binarity. Generally, foot size in BGW corresponds to, and is therefore constrained by, the size
from tri- and quadrisyllabic monomorphemic nominal words, which carry an audible prominence on the initial syllable only, and (in unemphatic speech) do not carry a pitch accent on any syllable other than the first (refer to Chapter 3, section 3.4). Indeed, the principal acoustic evidence for foot structure comes from the association of pitch accents to the heads of feet (Bishop 2001, 2002, Chapter 4 in this dissertation).

The **phonological word** is generally isomorphic with the morphosyntactic word, and is the domain in which accent is assigned, typically, to one or both peripheral feet in the word (see Chapter 3, section 3.11, and Chapter 6, section 6.3.2).

The phonological word corresponds to the minimal citation form for verbal and nominal words, in accord with one of the traditional criteria for phonological wordhood (Bloomfield, 1933:178), the ‘minimal free form’ criterion. Speakers will never cite bare verbal roots, but always fully inflected morphosyntactic verbal words. The minimal citation form for verbs is a root conjugated for tense/aspect/mood and a pronominal prefix (which may be a zero morpheme); for nouns, the minimal citation form is the nominal root with an obligatory noun class prefix. Only a handful of nominal roots, such as *duruk* ‘dog’ and *kukku*, ‘water’, do not have a noun class prefix. The order of the outermost morphemes in the morphosyntactic word is fixed; there is some slight variability of ordering only between a few adverbial prefixes in the verbal word, which always occur between the pronominal prefix and the conjugated root (Evans, in press: §8.1.2). The root and its obligatory flanking morphemes – noun class prefix or pronominal prefix – are not separable by (non-hesitation) speech pauses within discourse, nor are they separable by any morphemes other than prefixal morphemes or incorporated nominals, which belong to a very restricted subset of nominals. The morphosyntactically defined unit therefore also meets the traditional ‘cohesion’ criterion for phonological wordhood.

There are few phonotactic criteria which distinguish the word from the syllable; the phonotactic possibilities of words and syllables are near-identical (Evans, in press: §2.6). The principal phonotactic constraint limited to words is that they may not begin with the trilled ‘r’, [r], and the contrast between apical and retroflex rhotic segments is neutralised in this position.

---

of morphemes.
The *phonological phrase* is a level of phrasing which is demarcated by a low boundary tone (denoted $L_p$) at its right edge. The phonological phrase generally contains one phonological word, but may contain two (see Chapter 6, section 6.3.1 and Chapter 7). The phonological phrase is immediately dominated by the intonation phrase within the prosodic hierarchy postulated for BGW. Evidence for the phonological phrase from the Kuninjku dialect is given in Chapter 6. As yet, there is no systematic evidence bearing on the existence of this prosodic constituent level in the dialects other than Kuninjku. However, impressionistically, there is a similar level of tonally demarcated phrase in the other dialects: see Figure 2.29, an example from the Kunwinjku dialect

13 It could be argued that an alternative analysis of the word-final low tone targets in this example is possible. Such an analysis would attribute the L targets to leading L tones attached to the following accents – i.e. would label the accents $L+H^*$. This appears a plausible analysis, since the low target is temporally close to the following high pitch accent in each case. This kind of temporal proximity of two tone targets (one of them associated with a stressed syllable) is one of the principal diagnostics of bitonal accents. Further evidence from Kunwinjku of the kind illustrated in Figure 6.10 (Chapter 6) for Kuninjku, in which there is a clear low target marking the edge of the word *bi-rrubom*, is needed to secure the phonological phrase boundary tone interpretation of these tones.

No final lengthening is associated with the phonological phrase level (Chapter 6, section 6.5).

The *intonation phrase* is defined on the basis of three characteristics: the relative prominence of pitch accents, optional boundary tones ($H\%, \%H$ and $\%L$) and pitch reset.

The intonation phrase is the domain within which the relative prominence relationships of downstep and upstep are constituted. The term ‘relative prominence’ is typically used to refer to the perceived prominence of two or more accents within a single intonationally-demarcated phrase. Among the accents in the phrase, one accent tends to sound more prominent than the others. In BGW, downstep and upstep relations usually hold between accents in different phonological phrases, within a single intonation phrase. Thus, they provide one source of evidence for the latter level of prosodic constituency (see Chapter 3, §3.12).

At the left edge of the intonation phrase a new choice of pitch range is made. The left edge may also be optionally marked by an initial boundary tone, $\%L$ or $\%H$ (see Chapter 1, §1.7.3.2). There is no clear evidence of phonetic boundary-associated lengthening at the level of the intonation phrase (see Chapter 6, section 6.5).
Translation: The sorcerer killed her, that woman.

A sequence of intonation phrases constitutes an *utterance*. There are two principal characteristics of the utterance: the potential for final lowering and generally, the presence of substantial pause (see section 2.6.2.1). A low intonation phrase boundary tone at the right edge of an utterance may be phonetically lowered relative to preceding low boundaries, producing the effect of final lowering (see Chapter 6, section 6.4.4). Not all intonation phrase-final falls show this extra low pitch. There are no additional boundary tones associated with the edge of the utterance. However, the final two syllables of the utterance generally undergo phonetic lengthening as a correlate of the boundary (Fletcher and Evans 2000; Chapter 6, section 6.5 in this thesis).

Whenever grammatical analysts speak of certain words occurring under a ‘single intonation contour’ or with ‘a coherent intonation pattern’, the question arises as to what size or level of prosodic constituent the analyst is referring, and whether it is, in fact, always a constituent of the same size. In BGW, a contour containing a single pitch-accent rise followed by a fall to a low boundary could map to any one of the following: a phonological phrase, an intonation phrase, or an utterance. An analysis of constituent levels in Kunwinjku is developed in Chapter 6. Clear phonological specification of constituent levels is needed in order to avoid confounding potentially significant differences between the manner in which distinct constituent levels map to the grammar.
2.6.2 Other cues to prosodic constituent levels

The principle cues to the boundaries of prosodic constituents in BGW are, as described in section 2.6.1 above, tonal and durational. The segmental phonology of BGW provides no consistent cues to prosodic constituent boundaries of the kind described by Nespor and Vogel (1986). Occasionally, assimilatory palatalisation of a velar nasal /ŋ/ (producing a palatal nasal, /ɲ/) is observed across word boundaries (refer to Figure 7.21 (sound file 7.21) in Chapter 7). However, the irregularity with which this assimilation occurs indicates it is simply an occasional process found in connected speech. Other evidence for prosodic constituency comes from pause distribution, as discussed in the following section.

2.6.2.1 Pause duration, pause perception and the relationship between pause and prosodic boundary strength

Pause duration in relation to pause perception is a complex topic, and one which cannot be pursued at any length within the scope of this dissertation. See Carroll (1995) for a detailed treatment of pause durations in relation to rhetorical structure in the Kunwinjku dialect of BGW.

Butcher (1981) discusses some of the issues involved in the study of speech pauses. Principal among these is the lack of any necessary correlation between acoustic pause duration and pause perception: whether the speaker is perceived as having inserted a speech pause, and if so, the perceived duration of the pause. As Butcher points out (1981: 85), “the fact that the presence of a measurable period of silence is neither a necessary nor a sufficient condition for the perception of a speech pause was clear from the earliest instrumental studies”. Butcher cites a study by Boomer and Dittmann (1962), which he replicated, and which highlights one of the reasons for this lack of correspondence: “whereas within-clause pauses were detected by 75% of listeners at durations above 200ms, between-clause breaks were not heard until they were between 500 and 1000 ms in length”. That is, “the perceptual threshold for pauses increased as a function of syntactic complexity” (1981: 86).

In order to examine, in a cursory manner, my impressionistic observation that pause is only a correlate of the utterance level of juncture, but not of any lower prosodic constituent level (including the intonation phrase), I measured pauses of 150ms
duration and above in the CUCKOO text (10 minutes duration)\textsuperscript{14}. Where a pause of less than 150ms occurred at an utterance juncture, this was also noted. The measurements excluded periods of silence between voiceless segments, or attributable to a glottal stop, hesitations, and silences due to the speaker listening to a background noise or another speaker. Of the 148 turn-medial pauses above 150ms duration which were labelled, 100% occurred at utterance-level junctures (0% at intonation phrase-level junctures and phonological phrase-level junctures). In addition, 27 utterance-level junctures showed pauses of less than 150ms duration. In sum, 82% of pauses after utterance-level breaks were longer than 150ms. Figure 2.30 (below) illustrates the distribution of pause durations at utterance-level junctures. The majority of pauses are in the 500 - 1200 ms range; the mean pause duration for the text is 1147ms.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{pause_durations}
\caption{Distribution of pause durations at utterance-level boundaries (BI4 junctures)}
\end{figure}

\textsuperscript{14} 150ms is a relatively low minimum measure of pause. Carroll (1995) adopts a minimum pause duration of 200ms, but cites Heike, Kowal and O’Connell (1983: 203) as urging that pauses between 130 and 250 ms be examined.
2.7 An intonational grammar of BGW

In this section I describe the sequences of intonational tones which occur in BGW phrases. An intonational grammar is a summary of the attested intonational patterns of the language, and by extrapolation, a means of predicting patterns which should not occur.

One way of stating the intonational grammar is by means of a finite state machine. The finite state machine is essentially a metaphor for the manner in which the speaker progresses through a phrase, choosing each new intonational element depending on the ‘state’ she or he is currently in. In Pierrehumbert’s model of English intonation (Pierrehumbert, 1980), those states are the initial boundary tone state, the pitch accent state, the phrase tone state and the final boundary tone state. There are certain constraints inherent to each state in this model: a speaker can cycle numerous times through the accent choice state, for example, but can only choose once from the the phrase tone state and the initial and final boundary tone states:

![Finite State Machine Diagram]

Figure 2.31: Pierrehumbert (1980)’s finite-state grammar model of English intonation

A finite-state grammar in the form proposed by Pierrehumbert opens a very limited window between the part of the tonal string that has been implemented and that which remains to be constructed. The speaker chooses, each time anew, from the complete set of possible phonological choices at each point (‘state’) of the linear process. Since the tone choices are made purely locally, there are no non-linear constraints on accent and boundary tone choice imposed by different kinds of ‘global contour type’. The phonetic implementation procedures for the grammar, which turn out actual F0 values, are also only able to ‘look’ one tone forward.
There is evidence that the finite state grammar as proposed by Pierrehumbert may obscure actual patterns of dependence between tone choices. Pierrehumbert herself notes that though “we have not been able to identify any cooccurrence restrictions among the pitch accents, …it is, of course, possible that future research will.” (1980: 30). For example, there is beginning to be statistical evidence that speakers of English tend to choose specific sequences of accents and boundary tones (Dainora, 2002). This is not what a single-path finite state model would predict. Ladd (1986, 1996) claims that in English, within the prenuclear domain, pitch accent choice is constrained by the identity of the first accent, i.e. every pitch accent within the domain will be of the same kind. Another dependency has been suggested to hold between the initial boundary tone specification (which sets the preaccentual pitch level) and the first prenuclear pitch accent of the phrase in Dutch. Grabe et al. (1997) found that there is a dependency between the choice of preaccentual pitch level and the pitch level of the immediately following accent, such that a low preaccentual pitch level was typically associated with a high initial pitch accent, and high preaccentual pitch with a low first accent. Also, certain ‘pragmatic effects’ of the preaccentual pitch level appear to depend on the combination of preaccentual pitch with the following accent. Such claims do not invalidate the use of a finite-state model for an intonational grammar, but may require its operation to be constrained, e.g. by initial tone choice in a given domain of the phrase. Specification of the domains of particular constraints on tone choices would need to be built into the grammar in the form of further divisions within the phrase structure, such as preaccentual section/prenuclear accents/nuclear accents/boundary tone section. It may be that a more refined understanding of the mapping between semantics, pragmatics and intonation will arrive at a finding that there are in fact quite strong constraints on which combination of intonational tones is chosen at a given point in a discourse, or strong correlations between particular tunes and particular sets of words or grammatical constructions.

The intonational grammar of BGW presents an interesting example of a system which apparently cannot be expressed within a finite state model with a single path for the construction of tunes. In order to model the BGW grammar, high level and sustained high contours (contours ending in a high intonation boundary tone) must be separated out from other contours, since the combinatory possibilities of these types of contours are very reduced, relative to contours ending in a low boundary tone (see Figure 2.32). The high level F0 in these contours after the first
high accent makes the presence of any further H* accents medial to the contour indeterminable, even though the contour may contain a number of words which would otherwise be eligible for accent. There are also no examples of L+H* accents medial to high level contours. It appears that the absence of phrase-medial accentual prominences is part of the character of high level contours in BGW.

<table>
<thead>
<tr>
<th>Initial state (optional)</th>
<th>Second state (obligatory)</th>
<th>Third state (optional; max. 2 cycles(^\text{15}))</th>
<th>Fourth state (obligatory)</th>
<th>Final state (obligatory)</th>
</tr>
</thead>
<tbody>
<tr>
<td>%H</td>
<td>H*</td>
<td>H*</td>
<td>Lp</td>
<td>-%</td>
</tr>
<tr>
<td>%L</td>
<td>H*&lt;</td>
<td>![H*]</td>
<td>L+H*</td>
<td>H%</td>
</tr>
<tr>
<td></td>
<td>L+H*</td>
<td>![H*]</td>
<td>H*=&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>H*=&gt;</td>
<td>![H*]</td>
<td>Lp</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2.32: Finite state grammar for BGW, showing two divergent paths for the construction of intonational tone sequences in the IP. The lower trajectory represents the reduced combinatory possibilities observed in ‘high level’ contours in BGW.

\(^{15}\) There is only one, somewhat tenuous example in the corpus of three (H*) pitch accents in sequence, and these occur on a single word (Figure 3.15, Chapter 3).
2.8 Conclusion

In this chapter I have presented the principal declarative contours of BGW, and made preliminary observations in relation to contours applied to interrogative and imperative utterances. I have also outlined the evidence for the hierarchy of prosodic constituents in BGW, and their relationship to intonational tones. This evidence will be further elaborated in Chapters 3, 6 and 7, in which I will examine accent assignment, the phonological phrase boundary tone, and prosodic integration of phonological words in a single phonological phrase, respectively.

Three declarative contours were analysed in detail: those with a low-rising boundary, denoted \( L_p \) \( H\% \); high level contours, which phonetically arise from a sequence of an \( H^* \) accent and an \( H\% \) boundary; and stylised high sustained contours, which arise from a sequence of an \( H^* \) accent and a prosodic morpheme combining vowel lengthening with high tone (\( H:: \)). The vowel lengthening in the latter is variable, but well in excess of the lengthening associated with phrase-final lengthening, and can occur on a phrase-medial word.

Contours with a low-rising boundary are used to check the listener’s comprehension of a reference or scenario. High level contours are associated with a distinct set of pragmatic meanings: topicalisation; incomplete list or sequence of actions; and ‘iconic’ incompleteness, in which ‘suspended’ high tone across the phrase is iconic to an action or event that has almost, but not yet or not quite, occurred. In these high level contours, the \( L_p \) boundary tones of phonological phrases are generally absent. An analysis of this phenomenon will be given in Chapter 6.

Stylised sustained high intonation or word-final vowel lengthening combined with level or sustained high pitch was shown to be quite widespread among Australian languages. When used on verbal words in BGW, this contour prototypically indicates a durative aspectual distinction. When used on nominals and locative demonstratives, it generally dramatises the physical ‘extent’ of a material substance or geographical distance.

The distribution of contour types is one aspect of the intonation of BGW which is likely to vary considerably with text genre. High level contours and stylised high sustained contours are quite frequent in the narrative texts examined in this thesis, while contours with low-rising boundaries are relatively rare. Given the meanings associated with each type of contour, one would predict that more
interactive speech genres, such as conversation or dialogue, would show a greater predominance of low-rising boundaries, since these appear to have quite a marked interactive use in grounding references, while stylised high contours, being a device commonly used to dramatise narrated actions, would be considerably less in evidence.

Intonational differences among the dialects do not appear to be substantial. The few differences which are apparent are predominantly of the ‘systemic’ type, that is: ‘differences in the inventory of phonologically distinct tune types, irrespective of semantic differences’ (Ladd, 1996: 119, following Wells (1982)). For example, the initial low intonation boundary tone %L frequently occurs in Gun-djeihmi, but does not seem to feature in the inventory of Kuninjku. On the other hand, upstepping accent contours are only recorded in Kuninjku texts. These may be simply gaps in the data; further data in each dialect, from a larger number of speakers and a more extensive range of genres, are required in order to address this issue.
Chapter 3

Metrical structure and intonational pitch accent

3.1 Introduction and overview

In this chapter I describe the assignment of metrical structure in the phonological word, and examine in detail the relationship between metrical strength and intonational pitch accent in two dialects of BGW, Kuninjku and Manyallaluk Mayali. A distinction between underlying metrical structure and surface metrical structure is motivated on the basis of constrained variations in surface metrical structure across different tokens of the same, and near-identical, words.

The patterns of accent assignment described in this chapter (in particular, in sections 3.5.2 and 3.11) will be relevant to those seeking to understand and learn to hear and reproduce the pronunciation of ‘stress’ or rhythmic structure in BGW.

The specific aims of this chapter are as follows:

• To describe the correspondence between metrical structure and morphological structure in BGW;
• To describe the relationship between underlying metrical strength (as computed by metrical structure algorithms) and surface metrical strength (rhythmic structure realised by pitch accents). A Pre- and Post-Accent Metrical Head Deletion rule and a concomitant Stray Syllable Adjunction rule are proposed to account for mismatches in BGW between the underlying metrical structure, as computed on the basis of morphological constituency, and the surface or derived metrical structure, which corresponds to perceived rhythm;
• To describe dialectal differences in the metrical surface structures of words in Kuninjku and Manyallaluk Mayali;
• To describe the actual distribution of pitch accents in Kuninjku and Manyallaluk Mayali words as a function of (at least) two factors: underlying metrical structure within the phonological word domain, and principles of pitch accent assignment
related to edge-marking of that domain, including a distinct default accent assignment rule in each dialect;

- To describe the prominence relationships of downstep and upstep which may hold between accents in adjacent phonological phrases, within an intonation phrase.

The chapter is organised as follows. In section 3.2, I outline the relationship between intonational accent, phonetic stress and metrical structure in stress accent languages. In section 3.3, I introduce the concept of the bracketed metrical grid, as developed in Halle and Vergnaud (1987), and mappings between metrical and morphological structure. In section 3.4, I describe the morphological basis of foot construction in Kuninjku and Manyallaluk Mayali. Section 3.5 addresses the relationship between underlying and surface metrical structure in polymorphemic phonological words, in which the surface metrical structure reflects the impact of intonational accent on rhythmic prominence relations. Conversely, pitch accent ‘shifts’ attributable to the addition of morphemes to the word (thus adding to the metrical structure) provide evidence for the dependence of accent location on metrical structure (see section 3.8).

In Sections 3.6 to 3.10, I discuss four patterns of accent assignment which violate the regular relationship between underlying metrical structure and accent assignment. The patterns are: limited quantity-sensitive accent placement within roots; an additional penultimate accent (in Manyallaluk Mayali only) which is not predicted by the metrical structure as computed on the basis of the morphological structure; ‘emphatic’ accent on a metrically weak, morpheme-final syllable; and accent on a metrically weak, verb-final syllable, a pattern that is used with the interrogative and imperative constructions in Manyallaluk Mayali.

The actual patterns of distribution of one or more pitch accents in Kuninjku and Manyallaluk Mayali nominal and verbal words are the subject of section 3.11, where I seek to determine whether there is a default location for a single accent in the phonological word. Section 3.12 discusses the relationship between accent assignment, accentual prominence and aspects of information structure in Kuninjku, and Section 3.13 concludes the chapter.
3.2 Metrical structure in stress accent languages

3.2.1 Definition of metrical structure

Metrical structure is the phonological organisation of rhythmic prominence (Ladd, 1996: 56; Halle and Idsardi, 1995; Goldsmith, 1990; Halle and Vergnaud, 1987). The term ‘metrical structure’ is generally used to refer to strong-weak prominence relations contracted between syllables, as a result of their organisation into feet and phonological words. Considered more broadly as a relationship between stronger and weaker elements, ‘metrical structure’ may also exist at the level of the phonological phrase or the intonation phrase, where it may be manifested in relationships of relative prominence between accents in different words. A ‘metrical’ analysis of downstep has been championed by Ladd (1990a, 1990b, 1992a, 1992b, 1996), who analyses downstep in English as one manifestation of a metrical relationship between ‘stronger’ and ‘weaker’ prosodic prominences within a phrase. I refer to relationships between stronger and weaker accentual prominences in BGW as ‘relative prominence relations’.

3.2.2 Definitions of stress accent languages

In the so-called stress accent languages, intonational tones, referred to as pitch accents, associate with, or ‘anchor to’, metrically strong syllables, as determined by the relevant system of metrical structure assignment. This definition of pitch accent, originally from Bolinger (1958), is the one adopted in Pierrehumbert (1980), Beckman and Pierrehumbert (1986), Ladd (1996), the present dissertation, and other studies of stress accent languages framed in the autosegmental-metrical model. Stress accent languages thus defined include English, Dutch, German, Italian and a number of Australian languages, such as Dyirbal (King, 1994), Warlpiri (King, 1999) and Wik-Mungkan (Sayers, 1974).

There is another definition of stress accent found in the literature, which derives from Beckman (1986; see also Hualde et al., 2000). Beckman (1986) draws a contrast between lexical pitch accent, of the kind found in Tokyo Japanese, and stress accent, as

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1 It is possible for a language to have metrical structure at the level of the phonological word (or the phonological phrase), while not having structure at the level of the foot: the facts of accent in French suggest such an interpretation (cf. di Cristo, 1998: 196-199; Ladd, 1996: 57-58).

2 Ladd argues that in English, a downstepped accent can instantiate either the strongest or a weaker prominence within a phrase, depending on its location in relation to the prosodic structure of the phrase (see section 3.12.2).
exemplified by English, in terms of their **phonetic correlates**. She hypothesises that “…[s]tress accent *[meaning intonationally associated accent - JB]* differs phonetically from non-stress accent in that it uses to a greater extent material other than pitch.” While Beckman demonstrates that this is the case in relation to English stress accent, there is no necessary universality to the correlation between metrical strength, duration and intensity, as Beckman herself acknowledges.

The paradigmatic acoustic correlates of stress which have been most widely recognised in the literature on stress accent languages are statistically greater duration, intensity (or spectral shift\(^3\)) and F0 (e.g. Dogil and Williams (1999), Beckman (1986: 159-160, 168); King (1994; Dyirbal); Fant and Kruckenber (1993); Fant, Kruckenber and Nord (1991); Fry (1955)) as well as full vowel quality in stressed syllables compared with reduced vowel quality in unstressed syllables (e.g. Fear, Cutler and Butterfield (1995); de Jong (1995); van Summers (1987); Lindblom (1963)), and the potential for phonetic reduction or elision of unstressed syllables. In Chapter 4, I will examine duration, intensity, vowel quality and segment elision as correlates of metrical strength in the Kuninjkju dialect of BGW.

The emphasis in the present chapter is on the phonological relationship between metrical structure and pitch accent. As Beckman (1986: xi) writes,

> [i]f accent is to be separated from... other phonological uses of the same phonetic materials, the delimiting criteria must refer to attributes other than the physical characteristics of the sound patterns. They must refer to those aspects of the category’s distribution and occurrence that give clues to its phonological function.

I propose that the principal diagnostics of an intonational stress accent language should be **distributional** rather than **phonetic** ones, the general principle being that metrical units are needed to account for postlexical pitch accent placement. I suggest the following diagnostics: (1) that pitch accents can be assigned to different metrically strong syllables within the same word, as predicted by the metrical structure assignment algorithms of the language; and (2) that the positions of pitch accents in a word may ‘shift’ if metrical

---

\(^3\) Spectral shift is a phenomenon whereby frequencies above 500Hz show a greater increase in intensity than lower frequencies (Sluitjer and van Heuven, 1996; Sluitjer, van Heuven and Pacilly, 1997).
structure (for example, associated with an additional morpheme or morphemes) is added to the word (see Section 3.8 in relation to BGW).

3.2.3 Definitions of pitch accent

As described in Chapter 1, intonational pitch accents in stress accent languages are tones which are post-lexically assigned to metrically strong syllables. This definition of pitch accent is not to be confused with the common use of the term to refer to a lexically assigned tone which serves a distinctive function in the lexicon, as, for example, in Tokyo Japanese.

In the typological literature on accent, the term ‘pitch accent’ is also occasionally used to describe F0 excursions which serve a demarcative function in languages with accentual phrases (such as French: cf. di Cristo, 1998, though di Cristo refers to ‘tonal units’ rather than accentual phrases). This use of the term is not unrelated to the one intended here, since such pitch accents have also been claimed to be attracted to metrically strong syllables. In French, a pitch accent within a phrase domain roughly the size of the phonological phrase (containing a single content word and function word/s or clitics) aligns with the final unreduced (full vowel) syllable in the phrase, rather than any following reduced syllable. Ladd (1996: 55-59) argues that this constitutes evidence for the underlying metrical strength of the accented syllable. The principal difference between a language such as French and a ‘stress accent’ language appears to be the lack of variability in the location of the accent within the content words in the former. In a language such as English, this variability results from foot structure, which in polypedal words, creates more than one potential association point for accent.

3.3 Metrical constituency, morphological constituency and the bracketed grid

3.3.1 Metrical and morphological constituency

There is a fundamental correspondence in Bininj Gun-wok between underlying metrical structure and morphological constituency. The exceptions to this correspondence are

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4 The phenomenon of secondary rhythmic accent does not provide evidence for foot structure in French (di Cristo, 1998).

5 Refer to Chapter 1, §1.4.2, for the nominal and verbal morphological templates of BGW.
relatively few and mostly regular. Halle and Vergnaud (1987) propose a model for the computation of metrical structure which is well suited to the description of a language such as BGW. Their algorithm for computing the metrical structure of ‘simple inputs’ (those without pre-existing accented elements, as is the case in BGW) “takes the already existing natural bracketing as input and merely interprets it as a “metrical bracketing”’ (1987:115). ‘Natural bracketing’ includes the edges of morphemes, and therefore bears a basic correspondence to semantic structure:

Every input to a metrical rule is in fact endowed with a minimal constituent structure, since it is necessarily characterized as a morphological constituent that has a beginning and an end. Let us refer to such previously given constituent structure as natural constituent structure and to the corresponding boundaries and bracketing as natural boundaries and natural bracketing, respectively. (Halle and Vergnaud, 1987:114)

In this chapter I will adopt the formalism of the bracketed grid (Halle and Vergnaud, 1987; Halle and Idsardi, 1995) to annotate the two levels of prosodic prominence relevant to the discussion of stress and intonational accent in BGW. Bracketing at Levels 1 and 2 in the grid will be used to indicate metrical constituency at the level of the foot, corresponding to underlying metrical structure, and the accented foot, corresponding to surface rhythmic structure, respectively.

Following Halle and Idsardi (1995), a single open bracket is inserted at the edge of the morphological constituent to which the rules of metrical constituency construction refer. The grid itself is composed of asterisks, each of which locates a metrical head at the level of the line on which it occurs. At Level 0 of the grid, an asterisk is projected for every syllable head. For the sake of simplifying the illustrations, this level of prominence will not always be shown in the grid illustrations in this chapter. At Level 1 in the grid, feet are constructed according to the relevant parameters of the language (binary or unbounded; iambic or trochaic; quantity sensitive or insensitive; lexical accent or not). The head of each foot is marked by placing an asterisk above the appropriate Level 0 asterisk. At Level 2, relative prominence relationships among the heads of feet are indicated.

The levels of prominence in the grid are strictly ordered: a Level 2 asterisk must be added above a Level 1 asterisk. However, in the (marked) cases where a Level 2
asterisk is added to an asterisk projected only at Level 0, the missing prominence structure is induced, i.e., a Level 1 asterisk is added. In other words, an intonational accent (a Level 2 asterisk) will seek out the head of a foot (a Level 1 asterisk) with which to associate. If an intonational accent is forced to associate with a syllable that is not the head of a foot, then foot structure, with its usual prosodic correlates, will be induced in that syllable in order to license its carrying of accent (Jones, 1956: 255; Beckman, 1996). To illustrate with a (constructed) English example, in an utterance such as ‘It’s exported’, spoken unemphatically, the initial vowel of ‘exported’ is generally reduced to schwa, indicating the absence of stress. In this utterance, the word ‘exported’ will bear a (nuclear) pitch accent. The metrical structure of the word ‘exported’ in this context might be represented as follows. Level 1 represents the lexical assignment of metrical strength to the second syllable of the word. Level 2 represents the word under normal accentuation, in which a pitch accent is associated to the lexically stressed syllable /pɔ/:

\[
\begin{array}{llll}
2 & (*) & 1 & (*) \\
1 & (*) & 1 & (*) \\
\end{array}
\]

\[
{\text{exported}} \rightarrow {\text{exported}}
\]

However, in a context of a narrow focus utterance – such as the example proposed by Bolinger (1958, cited in Ladd, 1986) – ‘This whiskey wasn’t EXported, it was DEported’ – the syllable /eks/ may bear a pitch accent instead of the lexically stressed syllable /pɔ/, which is deaccented, but retains its full vowel quality. The relevant structure can again be represented in logical steps:

\[
\begin{array}{llll}
2 & (*) & 2 & (*) \\
1 & (*) & 1 & (*) & 1 & (*) & (*) \\
\end{array}
\]

\[
{\text{exported}} \rightarrow {\text{EXported}} \rightarrow {\text{EXported}}
\]

underlying metrical structure

accentuation of ‘ex’ under narrow focus

induction of metrical strength (level 1 *)

in the accented syllable
The syllable /ɛks/ under accent is realised with full vowel quality and full duration, whereas, when unaccented, as in the utterance ‘It’s exported’, the vowel /ɛ/ tends to be reduced, both in duration and vowel quality (i.e. centralised to schwa).

3.3.2 Types, tokens and the metrical grid: a note on terms and methodology

As a representational device, the metrical grid has the benefit, over the metrical tree, of enabling the clear representation of regular kinds of constrained variation in metrical structure, and their relationship to particular metrical contexts. Indeed, the grid was originally developed in order to more transparently illustrate regular causes of re-organisation in metrical structure, such as the presence of adjacent stresses at the same level of prominence (a stress (or prominence) clash context) or too many weak beats between stresses (a stress lapse context).

I will refer to the illustrations in this chapter as ‘tokens’, by which I mean that they are actually attested examples of regular kinds of variation in metrical structure in BGW. The underlying metrical structure is inferred on the basis of the observed variants and their contextual influences (if any). In using the word ‘token’, I draw attention to the fact that all examples used in the phonological literature are, in their origin, tokens, and tokens recorded or heard (or else imagined) in a particular prosodic and segmental context. The significance of this fact for the empirical validity of theories based on these tokens is only just beginning to be recognised. In particular, it is now argued in a number of quarters that a particular prosodic context – such as the citation form – should not be arbitrarily chosen as the ‘default’ or underlying representation of the prosodic structure of an expression, unless as full a gamut of prosodic contexts as possible is available for comparison – including citation forms (e.g. Pierrehumbert (1998); see Bruce (1977) for the original statement of this argument). The citation form, far from being the most simple form or prosodic context, is prosodically very enriched, carrying the prosodic correlates of a single intonational phrase and utterance in addition to the prosodic structure of the phonological word.
I therefore present the illustrations in this chapter as examples of attested variants in metrical structure, and as far as possible, seek to explain how these variants may be derived. In this manner, from among the variants, the most simple representation of the prosodic structure of an expression is reached by a process of elimination, by filtering out known or suspected sources and contexts of prosodic variation.

3.4 Metrical and morphological structure in BGW

In this section I will describe the metrical structure assignment algorithms in BGW, which give rise to the underlying metrical structures of words.

As described in Chapter 1 (§1.4.4), feet are left-headed and unbounded in all dialects of BGW. BGW displays quantity sensitivity only in limited circumstances (see §3.6), and has no lexical accent: no syllables are marked in the lexicon as associated with a tone.

3.4.1 Alignment of unbounded feet and morphemes

In BGW, the construction of metrical constituents makes reference to the left edge of the morpheme, which is constrained to align with the left edge of a foot (Evans, 1995; in press). This constraint is violated rarely, and under quite specific conditions (see §3.6, 3.7).

It is a corollary of foot unboundedness that there is typically a one-to-one correspondence between monomorphemes and feet. The cohering morphemes constitute a regular set of exceptions (Evans, 1995; in press); these are described below. The upper limit of foot size is therefore the upper limit of morpheme size. Morphemes in BGW are rarely longer than four syllables, and even morphemes of four syllables are relatively uncommon.

In the summary below, I have slightly reformulated some of the metrical structure assignment principles presented by Evans (1995; in press). The basic principles (or constraints) apply to both the Kuninjku and the Manyallaluk Mayali dialects, and examples are drawn from both.

Foot construction in Bininj Gun-wok: (adapted from Evans (1995; in press))

- Feet are left-headed and unbounded.
- The left edge of a morpheme must align with the left edge of a foot; therefore:
- Each morpheme minimally corresponds to a single foot, with the exception of a set of cohering morphemes, which form a foot together with the preceding morpheme.

The unbounded left-headed feet of BGW can be contrasted with the trochaic, binary feet found in another language of the Gunwinjguan family, Ngalakgan (Baker, 1999). The following examples illustrate the contrast between the footing (Level 1 grouping) of a quadrisyllabic, monomorphemic word composed entirely of open syllables, in Ngalakgan, and in BGW. The metrical heads of feet are marked in bold.

\[
\begin{array}{c}
1 & (\ast & \ast \ast \ast \ast \\
0 & \ast & \ast \ast \ast \\
\end{array}
\]
\[
\text{ngorlomoro} / \eta\eta\eta\eta\eta\eta\eta / [\eta\eta\eta\eta\eta\eta\eta] \quad \text{‘nail-tailed wallaby’} \\
\text{(Ngalakgan: Baker, 1999: 34)}
\]

\[
\begin{array}{c}
1 & (\ast & \ast \ast \ast \ast \\
0 & \ast & \ast \ast \ast \\
\end{array}
\]
\[
\text{gorlomomo} / \eta\eta\eta\eta\eta\eta\eta / [\eta\eta\eta\eta\eta\eta\eta] \quad \text{‘fresh water crocodile’} \\
\text{(BGW, Manyallaluk Mayali dialect)}
\]

not:
\[
\begin{array}{c}
1 & (\ast \ast & (\ast \\
0 & \ast \ast \ast \ast \\
\end{array}
\]
\[
*\text{gorlomomo}
\]

\text{Sound file 3.1: } \text{Utterance medial, accented token, pronounced } [\eta\eta\eta\eta\eta\eta\eta] \text{ (in the phrase gorlomomo nawu, ‘that freshwater crocodile’)}

\text{7 This constraint is similar to the ‘Morpheme-to-Stress Principle’ proposed in Fitzgerald (1997).}
Figure 3.1: Wideband spectrogram of *gorlomomo nawu*, showing reduction of the third vowel in *gorlomomo*
3.4.2 Foot construction in monomorphemic words

Only a few sets of words are truly monomorphemic in BGW. These include nominal words lacking a noun-class prefix, some independent pronouns, some adverbal and prepositional words, and interjections. Verbal words are always morphologically complex, even monosyllabic words: the minimal verbal word comprises a pronominal prefix (which may be a zero prefix), a root and a TAM suffix (which may cohere with the root to form a monosyllable). In monomorphemic words and monosyllables, surface and underlying metrical structures are necessarily the same, whereas in polymorphemic words of two or more syllables, the mapping between surface and underlying metrical structures may vary according to the placement of pitch accent. For this reason, a detailed discussion of foot construction in polymorphemic words is deferred until section 3.5, where the interaction of accent with metrical structure is described.

Monosyllabic words are generally closed syllables. The level 2 asterisk denotes accentual prominence. Phonetic transcriptions are given in square brackets.

\begin{verbatim}
1 (*
0 *
  ngad [ŋat]  'we'

1 (*
0 *
  wanjh [waŋ?]  'then'
\end{verbatim}

Bisyllabic nominal roots are always stressed on the initial syllable of the root and when accented, carry accent on this syllable:

\begin{verbatim}
2 (*
1 (*
0 * *
  bininj [bĩnĩŋ]  'man'

Sound file 3.2: Utterance-final accented token of /bĩnĩŋ/ ([bĩnĩŋ]) (MM, speaker MK)

2 (*
1 (*
0 * *
  daluk [daluk̚]  'woman'

Sound file 3.3: Utterance-unique, accented token of /dalug/ ([daluk̚])
\end{verbatim}
Other bisyllabic nominals which follow this pattern are:

- **nani**  [nani]  ‘this (masc.)’
- **ngaleng**  [ŋalŋ]  ‘she’
- **duruk**  [duŋk]  ‘dog’
- **jamo**  [jamɔ]  ‘dog’ (MM only)
- **gunak/kunak**  [günak]  ‘fire’
- **gukgu/kukku**  [gukːu]  ‘water’

Trisyllabic nominal roots with all light syllables form feet with initial stress. This pattern confirms that the form of feet is left-headed. If the footing was iambic, the second or third syllable would be the metrical head.

\[
\begin{array}{ccc}
2 & (*) & \\
1 & (*) & \\
0 & * & * & * \\
\end{array}
\]

- **korroko**  ‘already’

*Sound file 3.4:* Utterance-final accented token of /ɡɔŋɔɡɔ/ ([ɡɔŋɔɡɔ]) (Kuninjku, speaker MK)

\[
\begin{array}{ccc}
2 & (*) & \\
1 & (*) & \\
0 & * & * & * \\
\end{array}
\]

- **ngurrurdu**  ‘emu’

*Sound file 3.5:* Utterance-initial accented token of /ŋuɾuŋu/ ([ŋuɾuŋu]) (Manyallaluk Mayali, speaker PB)

\[
\begin{array}{ccc}
2 & (*) & \\
1 & (*) & \\
0 & * & * & * \\
\end{array}
\]

- **djukerre**  ‘female black wallaroo’

*Sound file 3.6:* Utterance-unique accented token of /juɡɛɾɛ/ ([juɡɛɾɛ], Kuninjku, speaker MK)

---

* Garde (ms), Draft dictionary of Kuninjku.
Other trisyllabic left-headed feet include:

```
2  (*)
1  (*)
0  *  **
```

doddoro ‘chestnut quilled rock pigeon’

*Sound file 3.7: Utterance-final accented token of /dɔtɒrə/ ([dɔtɬɾə], Kuninjku, speaker MK)*

- ngalengman /ŋaɬêŋman/ ‘herself’
- judubu /jʊdubu/ ‘cooking stone’
- biliken /bɪłɪɡən/ ‘billycan’

Quadrisyllabic nominal roots are quite rare. An example of such a root in Manyallaluk Mayali, containing all open syllables and forming a single left-headed foot, was illustrated in Sound file 3.1/Figure 3.1 above (gorlomomo). The vowel reduction in the third syllable (shown in Figure 3.1) indicates footing is unbounded, not binary, since if footing was binary, this vowel should be metrically strong.

Another example from Manyallaluk Mayali, with a closed second syllable, but stress and accent on the initial syllable only, is the following. No tokens of this word with accent on the third syllable are attested in the corpus.

```
2  (*)
1  (*)
0  *  *  *  *
```

nganapbaru /ŋaŋapəru/ ‘water buffalo’

*not:*

```
2  (*)  (*
1  (*)  (*
0  *  *  *  *
```

*nganapbaru*
A Kuninjku example is the word *djalamardawk*, which has all open syllables except for the last, and is also stressed on the initial syllable only. Again, no token with accent on the third syllable has been attested.

2 (*
1 (*
0 * * * *

* djalamardawk /jalamadawg/ ‘bush passionfruit’

not:

2 (* (*)
1 (* (*)
0 * * * *

*djalamardawk

*Sound file 3.8: Utterance-unique accented token of /jalamadawg/ ([jalamadawg]) (Kuninjku, speaker MK)*
Figure 3.2: Wideband spectrogram of *djalamardawk* showing relative lack of intensity of the third /a/ vowel (possibly partly due to its rhotacisation in anticipation of the following retroflex stop), in contrast with the initial two /a/ vowels. Note the strong intensity and full vowel quality of the second vowel, despite its metrical weakness. This strong intensity and full vowel quality is often found in immediate post-accentual syllables in BGW (compare Figure 3.1).
3.4.3 Alternative morphological and metrical analyses of morphemes

In a few cases, alternative morphological analyses by speakers give rise to alternative metrical analyses of otherwise identical morphemes. Such alternative footings are attested with the trisyllabic sets of pronominal prefix morphemes. These morphemes may be analysed by speakers either as a single portmanteau morpheme or as two constituent morphemes, and are footed accordingly. Evans (in press, §2.5.2.2) gives an example of the Gun-Djeihmi third person augmented non-past prefix, \textit{gabarri-}, which is analysable either as a single morpheme or as two: \textit{ga-}, ‘non-past’ and third person augmented, \textit{barri}-:

\begin{verbatim}
1  (*                          (*
0 * * *                * * *
gabarri-   ~   gabbarri-
\end{verbatim}

\[
\begin{array}{c}
gabarri\text{(\textit{gab\’Ri})} \\
gabarri\text{(\textit{gabaRi})}
\end{array}
\]

\textit{Sound file 3.9:} Intonation-phrase-unique token of \textit{/gabar\textsubscript{i}b\textsubscript{a}ri\textsubscript{u}ŋ / (\{gab\textsubscript{a}ri\textsubscript{u}ŋ\})} (MM, speaker PB)

Speakers of different dialects may favour one or other of the footings; speakers of Manyallaluk Mayali invariably adopt the second (sound file 3.9).

In Kuninjku, and also the Kunwinjku dialect, the second morpheme is ‘birri’ rather than ‘barri’, and the favoured footing has the initial syllable, rather than the second, as the metrical head:

\begin{verbatim}
1  (* * * 
0 * * *

kabirri-
\end{verbatim}

\textit{Sound file 3.10:} Intonation-phrase-unique token of \textit{/gab\textsubscript{a}ri\textsubscript{b}irri\textsubscript{a}ld\textsubscript{i} /} (Kuninjku)

Other examples of alternative morpheme analyses affecting parsing into feet are the demonstrative \textit{namekke}, meaning ‘that one’, analysable as a single morpheme or as the masculine noun class \textit{na-} plus the demonstrative root \textit{-mekke}; and the interrogative \textit{nangale}, meaning ‘what’, analysable as a single morpheme or as a sequence of the noun class marker \textit{na-} and the interrogative root \textit{-ngale}:
Both variants of namekke are attested in the course of a single text (BILLABONG) by the Kuninjku speaker MK2. Evidence for the two morpheme analyses of this word comes from the fact that two patterns of accentuation occur – initial or medial syllable accent. This indicates that this speaker is able to foot the word in accord with either morpheme analysis. However, medial accent is much less frequent: out of twelve occurrences of namekke in this text, only one bears medial accent.

Sound file 3.11: Utterance-medial token of /namEk˘E/ with initial syllable accent
Sound file 3.12: Utterance-initial token of /namEk˘E/ with medial syllable accent

3.4.4 The cohering morphemes

In all dialects of BGW, the cohering morphemes form a set of principled exceptions to the generally one-to-one mapping between feet and morphemes. By definition, cohering morphemes are those which form a single foot with a preceding or a following morpheme. These morphemes are the ‘towards’ prefix -m-, the ‘immediate’ prefix -h-, the reciprocal/reflexive suffix -rr-, and the TAM (tense, aspect, mood) suffixes (Evans (1995; in press: §2.5.2). The TAM morphemes form a single foot together with the preceding root morpheme, which they conjugate. The reciprocal/reflexive suffix forms a separate conjugational series with the TAM markers; this series of TAM markers then form a single foot with the preceding root. The towards and immediate prefixes syllabify as a coda consonant to the rightmost syllable of the pronominal prefix, and do not affect the footing of the prefix.

The canonical metrical structures of root + TAM sequences are illustrated below. The metrical structure of the stem is not affected by the length of the preceding prefix(es) (monosyllabic, disyllabic, etc.), as these are independently assigned metrical structure. A final monosyllabic morpheme is generally unable to receive a pitch accent (see section 3.5.5; for marked cases of final syllable accent, see sections 3.9 and 3.10). When a
monosyllabic prefix (e.g. *ka*, 3sgNP) combines with a monosyllabic root + TAM (e.g. *bun*, kill/hitNP), this constraint on word-final accent results in the surface metrical structure *[ká-bun]* (see Section 3.5.1). In the examples below, the metrical heads of feet are in bold type.

\[
\begin{align*}
[ka]-[bu-n] & \quad 3\text{-hit/kill-NP} & \quad \text{‘He/she/it hits/kills it’} \\
[kabi]-[bu-n] & \quad 3/3\text{higher.animate-hit/kill-NP} & \quad \text{‘He/she/it hits/kills him/her’} \\
[ka]-[bongu-n] & \quad 3\text{-water.eat-NP}^{10} & \quad \text{‘He/she/it drinks’} \\
[ka]-[nalkbu-n] & \quad 3\text{-cry-NP} & \quad \text{‘He/she/it cries’} \\
[ba]-[bongu-ni] & \quad 3P\text{-water.eat -IMPER} & \quad \text{‘He/she/it was drinking’} \\
[ba]-[nalkbu-ni] & \quad 3P\text{-cry-IMPER} & \quad \text{‘He/she/it was crying’}
\end{align*}
\]

Trisyllabic roots are relatively rare, and the surface metrical structure of trisyllabic roots is sensitive to the relative syllable weight (light CV vs heavy CVC(C)) of the initial and second syllables. This and other irregularities of metrical structure due to limited quantity sensitivity are discussed in section 3.6. No quadrisyllabic verb stems were recorded in the present corpus.

3.5 Metrical structure and intonational pitch accent assignment

In BGW, metrical structure built upon the morpheme structure of words scaffolds the assignment of pitch accent. The phonological word in BGW can carry more than one pitch accent\(^{11}\): usually two, but, very rarely, three (see Figure 3.15 for the F0 trace of a word with three pitch accents). On present evidence, verbal and nominal words are rarely, if ever, unaccented\(^{12}\); all other words, excluding discourse interjections and connectives, are more frequently accented than not (see Chapter 7, Table 7.1).

---

\(^{9}\) See Figure 7.15 in Chapter 7 for an illustration of medial accent on *namekke*.

\(^{10}\) *bongun*, which is derived from the morphemes *bo*, ‘liquid’, and *ngun*, ‘eat’, is synchronically a fully lexicalised compound (therefore, a bisyllabic root).

\(^{11}\) In this it differs from Warlpiri, for example, in which, on present evidence, there appears to be no more than one accent per phonological word: Pentland and Ingram, 2001; Harrington, Butcher and Palethorpe, 2000).

\(^{12}\) In phrases ending in a low boundary tone; see Chapter 2 in relation to the interpretation of accents in phrases ending in a high boundary tone.
Leaving aside the general unaccentability of final monosyllabic feet (see section 3.5.5), not all metrically strong syllables in a word or phrase in Bininj Gun-wok bear pitch accents, though all have the logical potential to do so. The same phonological word may bear one accent in one utterance, and two in another (see Figures 3.3 and 3.4).

Baker (1999) observes a similar “distinction between stress and pitch-accent” in Ngalakgan. The need for the distinction, he says, is evident in the fact that “not every strong beat in a word is associated with distinctive pitch” (1999:14). Baker also observes patterns of one vs two accents on the same morphosyntactic word; where Ngalakgan appears to differ from BGW, however, is in allowing more than one accent on a monomorphemic nominal word (Baker 1991: 34-35; see sections 3.4.1 and 3.4.2 above). This possibility, as discussed above, indicates a difference in the mapping between foot structure and morphological structure in BGW and Ngalakgan.

This variability in the assignment of one vs two pitch accents in BGW polymorphemic words means that the principles underlying actual pitch accent assignment need to be formalised. The work described in this dissertation goes some way toward that formalisation, however, the principles governing the assignment of a single vs two (or three) accents in the word remain to be determined by future work. It is likely that dialogue data, in which the pragmatic function of words is deducible (i.e. their information structure and their role in dialogue acts), will reveal further patterns in the assignment of single vs multiple accents. For example, there may be a phenomenon something like the sentence accent in Swedish (Bruce, 1977), which contributes an extra accent to the word when it carries sentence focus.

Another possibility is that the number of accents carried by a word is prosodically conditioned – say, a reflex of its position in the intonational phrase (e.g. a way of marking initial or final position in the phrase). In English, for example, there is a greater tendency to accent a secondary stressed syllable early in the word when that word is the first in an intonational phrase (Shattuck-Hufnagel, Ostendorf and Ross, 1994). Impressionistically, however, the number of accents is not conditioned by phrase position in BGW:

13 There is one nominal word in the corpus, wirriwirriyak, ‘willy wagtail’, which in two tokens bears an accent on both ‘wi’ syllables, thus constituting an apparent exception to this statement. However, though it would otherwise seem a fully lexicalised expression, the word (which N. Evans (pers.comm.) suggests is onomatopoeic in origin) may be etymologically derived from a reduplicant morpheme and its base (wirri + wirriyak). If so, a trace of the original morpheme structure may be still conditioning the foot structure for this word.
accented words are frequently the only word in an intonation phrase or utterance, for example (see Figures 3.3, 3.14), and double-accented words appear to be equally frequent IP-initially and finally (e.g. Figures 3.4, 3.16). Evidence against an additional accent being a simple correlate of phrase-finality comes from Figure 3.25 (darrgid-no). In this example, the nominal word darrgid-no (alive-POSS, ‘alive’) is double-accented both when it is the only word in the intonation phrase and when it precedes another word in the phrase.

Finally, there is a clear correlation between some form of ‘emphasis’ and the assignment of an additional accent to a syllable which would not normally bear accent. This is the subject of sections 3.9 and 3.10 below.

3.5.1 Pre- and Post-Accent Metrical Head Deletion in BGW

In this section, I describe the relationship between pitch accent, the underlying metrical strength of syllables, and the perceived rhythm of words – the prominence patterns commonly referred to as ‘word stress’.

In BGW, the question remains open as to whether, in the absence of accent, an underlyingly metrically strong syllable is realised with any greater degree of surface prosodic prominence than an underlyingly weak syllable. This question is not addressed in this dissertation. However, even if there is a phenomenon of ‘secondary stress’ in BGW – perceptible (surface) prominence in an unaccented, metrically strong syllable – it is not audible in a syllable that is adjacent to an accented syllable.

Rules of stress deletion on a syllable adjacent to a ‘main stress’ are quite common in the literature. Halle and Vergnaud cite two cases of ‘pre-stress destressing’: one in Tiberian Hebrew, “that deletes a line 1 asterisk directly before main stress (that is, before a line 2 asterisk)” (Halle and Vergnaud, 1987:69), and another in Chamorro (Chung, 1986: 58) observes (in relation to English): “There remains the question of words in which the first full syllable is not separated from the syllable that carries the primary, for example routine, Chinese, ornate. It is sometimes argued that such words have no secondary, and it is true that the nearness of the primary deafens us to the prominence of the secondary; this has consequences in the evolution of words, since a full syllable in this position tends to be reduced eventually…. [But] we need to retain a potential for accent on an unseparated secondary to account for the shift in prominence from primary to secondary in phrases.” (emphasis added)

In BGW, a bimorphemic word with an accent on a monosyllabic foot followed by an unaccented bisyllabic foot is not audibly distinct in its prominence pattern from a trisyllabic, monomorphemic word in which an accent falls on the head of the only foot. Both words give the rhythmic impression of a single, left-headed foot. This is illustrated by the two nominal words below: na-ngamed (‘MA-what’s-his-name/who’), comprised of a gender agreement prefix na- and the root -ngamed, and korroko (‘long time ago, already’), a monomorpheme. Morpheme boundaries are indicated by square brackets.

```
2 (*)
1 (*)
[na]-[ngamed]  ‘what’s-his-name’
```

*Sound file 3.13:* Utterance-final accented token of /naŋamɛd/ ([naŋamɛt]) (Kuninjku, speaker MK)

```
2 (*)
1 (*)
[korroko]  ‘already, a long time ago’
```

*Sound file 3.14:* Utterance-final accented token of /ɡɔrɡɔ/ ([ɡɔrɡɔ]) (Kuninjku, speaker MK)

In order to account for such patterns of surface rhythmic prominence in polymorphemic words in BGW, I posit a rule of Pre- and Post-Accent Metrical Head Deletion. This rule predicts that a syllable which is underlingly metrically strong, but unaccented, will be as lacking in rhythmic prominence as an underlingly metrically weak syllable, when adjacent to an accented syllable. That is, in the immediate vicinity of an accented syllable, there are only two levels of rhythmic prominence: accented and unaccented.

As a metrical rule, Pre- and Post-Accent Metrical Head Deletion is of a body with rules such as Line Conflation (Halle and Vergnaud, 1987: 50-55), which are motivated by the need to explain surface metrical structure by recourse to an underlying level of
structure, from which it is derived, but some or most of which is deleted in the process of derivation.

A corollary of the Pre- and Post-Accent Metrical Head Deletion rule is that the syllable/s left defooted by the rule must be re-absorbed by the surrounding metrical structure. This re-absorption completes the process by which what was a stressed syllable comes to be an unstressed syllable in a surface metrical foot. Following Kager (1995: 381), I refer to this process as ‘Stray Syllable Adjunction’.

The surface footing of the above example (na-ngamed) is derived by applying Post-Accent Metrical Head Deletion and Stray Syllable Adjunction as follows.

Example 3.1: Post-Accent Metrical Head Deletion in a bimorphemic word

| OUTPUT: [na][ngamed] | ‘noun class (masc.)-who’ (Kuninjku) |

(1) Initial constituency assignment:

1  (*  (*
0  [na][ngamed]

(2) Accent is assigned to the leftmost foot:

2  (*
1  (*  (*
0  [na][ngamed]

(3) Post-Accent Metrical Head Deletion and Stray Syllable Adjunction apply:

2  (*
1  (*
0  [na][ngamed]

(Refer to Sound file 3.13)
Example 3.2: Pre-/Post-Accent Metrical Head Deletion in a trimorphemic word

OUTPUT: [na][djal][yahwurdurd] ‘noun class (masc.) - just - small.one’ (Kuninjku)

(1) Initial constituency assignment:

\[
\begin{array}{c}
1 \ (* \ (*) \ (*) \\
0 \ [na][djal][yahwurdurd]
\end{array}
\]

(2) Accent is assigned to the leftmost and the rightmost foot:

\[
\begin{array}{c}
2 \ (* \ (* \ (*) \\
1 \ (* \ (*) \ (*) \\
0 \ [na][djal][yahwurdurd]
\end{array}
\]

(3) Post-Accent Metrical Head Deletion is applied, then Stray Syllable Adjunction refoots the de-footed syllable, hence:

\[
\begin{array}{c}
2 \ (* \ (* \ *) \\
1 \ (* \ *) \ (*) \\
0 \ [na][djal][yahwurdurd]
\end{array}
\]

Sound file 3.15: Utterance-final token of /najalja?wurdurd/ (Kuninjku, speaker MK), ‘the smallest one’

Example 3.3: Pre- and Post-Accent Metrical Head Deletion in a trimorphemic word

OUTPUT: [ngal][dah][daluk] ‘noun class (fem.)-REDUP-woman’ (Kuninjku)

(1) Initial constituency assignment:

\[
\begin{array}{c}
1 \ (* \ (*) \ (*) \\
0 \ [ngal][dah][daluk]
\end{array}
\]

(2) Accent is assigned to the medial foot:

\[
\begin{array}{c}
2 \ (* \ *) \\
1 \ (* \ *) \ (*) \\
0 \ [ngal][dah][daluk]
\end{array}
\]
Pre- and Post-Accent Metrical Head Deletion is applied, then Stray Syllable Adjunction refoots the de-footed syllables after the accent, hence:

\[
\begin{array}{c}
2 & (*) \\
1 & (*) \\
0 & \text{ngal}[^a]dah[^a][daluk] \\
\end{array}
\]

*Sound file 3.16: Utterance-initial token of /ŋal ¿da ¿dalu g/ (/[a ¿da ¿dalu k ]/) (Kuninjku, speaker MK)*

The same process applies to produce the following surface footings (all are from the Kuninjku dialect):

- \([\text{kun}][\text{wok}][\text{duninj}]\) Gloss: IV-language/speech-proper
  Translation: ‘real (or proper) language’

- \([\text{kun}][\text{dung}][\text{kudji}]\) Gloss: IV-sun-one
  Translation: ‘day long, (during) a single day’

*Sound file 3.17: Utterance-initial token of /gunduŋuji/ (/gunduŋuji/)*

- \([\text{kun}][\text{wernh}][\text{yungkih}]\) Gloss: IV - truly - long.ago
  Translation: ‘a very long time ago’

3.5.2 Adjacent accents in polymorphemic words

3.5.2.1 Tolerance of ‘prominence clash’ in BGW

The preceding section has described the rhythmic characteristics of polymorphemic words in which there are underlyingly metrically strong, but unaccented, syllables adjacent to accented syllables.

In this section I describe the rhythmic characteristics of words in which two adjacent, metrically strong syllables both carry a pitch accent\(^{16}\), and briefly sketch the F0 patterns associated with double accentuation. These patterns, and the literature on ‘stress’ or ‘accent clash’ are reviewed in greater detail in Chapter 5, sections 5.4.2.2 and 5.4.2.4.

BGW appears to be unusually tolerant of what in other languages would be classified as prominence ‘clash’ situations: adjacent strong elements at the same level in the metrical grid. Polymorphemic words in BGW are characterised by the frequency of

\(^{16}\) As mentioned earlier in section 3.5, it is not clear what actually conditions the assignment of one vs two pitch accents to a word. I intend only a description of the patterns in this section; an explanation awaits further research.
adjacent accented heads of feet; it is this, in part, which gives the language its particular rhythms. These rhythms can be very confusing to the English learner trying to discern a single primary stress in a BGW word: a manual for English-speaking learners of the Kunwinjku dialect of BGW (by writers with long experience of Kunwinjku) advises that in pronouncing words, learners try to say each syllable of the word with equal emphasis, in order to approximate Kuninjku stress patterns (Etherington and Etherington, 1998).

The prevalence of adjacent accents in BGW words is a consequence of three factors: the correspondence between each morpheme and a foot; the typologically unusual absence of prominence-clash effects between metrical heads at the same level in the grid (cf. Shattuck-Hufnagel, Ostendorf and Ross, 1994 on such effects in English); and the lack of a phonological restriction on foot size (monosyllabic feet are common). Patterns of adjacent accent reflect the presence of adjacent metrically strong syllables.

Where there is more than one accent associated with a polymorphemic word in BGW, each accent is represented by an asterisk at the same level in the grid (Level 2). Dual accents are usually of equal perceptual prominence. The fact that each accent is marked at the same level in the grid represents the fact that all pitch accented heads of feet belong to the next highest level of metrical structure to the one indexed by underlyingly metrically strong syllables.

3.5.2.2 Differences in rhythmic prominence between single and double accented words

F0 traces, together with auditory information, are interpreted as showing adjacent accents using the following heuristic. If the F0 trace rises to a peak between two underlyingly metrically strong syllables, and if the rhythmic prominence of both syllables is impressionistically equal, then a high pitch accent is marked on both syllables. Otherwise – depending on which syllable gives the stronger impression of rhythmic prominence – one or the other syllable is labelled as accented.

The F0 traces for a single initial accent (as in Figure 3.3 below) and double accent (as in Figure 3.4) may appear quite similar: a rise or level high pitch across the first

---

17 I refer here to my own perception of the accents, but the reader may judge for her or himself by listening to the tokens. This of course has consequences for the analysis of ‘primary stress’ in BGW: in section 3.11 I argue there is little evidence for word-level culminativity in BGW.

18 By impressionistically, I mean combining auditory information with observation of the acoustic waveform.
syllable, followed by a fall across the second. However, auditorily, the difference in rhythm between them is readily apparent (compare sound files 3.13 and 3.18).

In these two examples, the alignment of the pitch peak is also quite distinct: in Figure 3.3, the single-accented token, the peak is aligned in the middle of the first syllable and the F0 begins to fall well before the onset of the second, while in Figure 3.4, the steepest section of the fall begins shortly after the onset of the second syllable.

Figure 3.3: Single-accented, utterance-unique token of na-ngamed, ‘what’s its name’

Refer to Sound file 3.13

Example 3.4:

| OUTPUT: [na][ngamed] | ‘noun class (masc.)-who’ (Kuninjku) |

(1) Initial constituency assignment:

1  (*  (*
0  [na][ngamed]
(2) Accent is assigned to both the leftmost foot and the final foot:

\[
\begin{array}{c}
2 & (* & (*) \\
1 & (* & (*) \\
0 & [na][ngamed] \\
\end{array}
\]

Sound file 3.18: Intonation-phrase unique token of /naŋamed/ ([naŋamed])

Figure 3.4: Double-accented, utterance-final token of na-ngamed, ‘what’s its name’

Double accent patterns on adjacent stressed syllables have been described in the IPO literature on Dutch intonation (t’Hart, Collier and Cohen, 1990), and the Kiel Intonation Project on German intonation (Kohler, 1990). They are sometimes referred to as the ‘pointed hat’ pattern (see Chapter 2, §2.3.1).

In Kohler (1990: 322-327), the problem of distinguishing a single accent on the first of two adjacent stressed syllables from an accent on each is discussed in terms of the timing (rate and alignment) of the F0 fall across the second syllable, and the ‘relative weighting’ perceptually of the high peak and following low tone target in the second syllable that changes in timing produce. Kohler’s examples of adjacent stresses all involve two words. Stressed syllables in German are lengthened relative to unstressed
syllables, so both of the adjacent stressed syllables, whether accented or not, can be assumed to be relatively long.

Kohler describes the cues to accent on the first vs both syllables purely in terms of the timing of the F0 targets involved. In the German hat pattern contours described, the low target is the more phonologically significant element of the second accent (in ToBI terms, it is an H+L* accent), and not the high peak (Kohler, 1990: 323). Therefore a slower fall in the second accent tends to increase listener judgments of a single accent on the initial stressed syllable rather than an accent on each of the two adjacent stresses (merged to form a single peak). This is because a slower F0 fall rate lessens the duration, and therefore the salience, of the actual low target on the second syllable (i.e. a smaller proportion of the second syllable is fully phonetically low, since F0 is in the process of falling throughout much of the syllable). This means the hearer is less likely to judge the second syllable as bearing the L* target of an H+L* accent.

Conversely, in hat patterns where a high tone target is the salient feature of the second accent, one might expect that the longer the F0 remains high in the second syllable, the more likely that syllable is to sound accented.

Also relevant to accent perception is work by Hasegawa and Hata (1992, 1995). Hasegawa and Hata examined accent perception as a function of F0 peak location in Tokyo Japanese and English. They studied instances in which the F0 peak of a lexical pitch accent (in Tokyo Japanese), or intonational accent (in English), is delayed to early in the post-accentual syllable. Comparing F0 as an acoustic cue to accent perception in English and Tokyo Japanese, they report that (1992: 87):

… the later the F0 peak occurs in a given syllable, relative to the syllable boundary, the greater the F0 fall rate necessary for listeners to perceive the preceding syllable as accented. […] this phenomenon is not unique to Japanese: perception of accent location in English is also influenced by both F0 peak location and post-peak F0 fall rate.

In Japanese, there is no possibility of double accentuation, since a single accent (H) is lexically assigned. Hasegawa and Hata’s studies therefore relate to whether the accent is perceived on the lexically accented syllable, or, anomalously, on the following syllable, when the peak associated with the lexical accent is delayed into the following syllable. In
Tokyo Japanese, “accent is realized solely by a change in pitch, not by a change in loudness or duration such as found in English” (1995: 142).

The relevance of Kohler’s and Hasegawa and Hata’s findings here lies in what the findings tell us about the mechanisms of accent perception (see also the discussion of House (1990) on tonal perception in Chapter 5, section 5.3). Further work on BGW is needed to examine whether, in the context of two adjacent metrically strong syllables, the alignment of the onset of the F0 fall in the second syllable, or the rate of the fall, contributes to the perception of whether or not that syllable is accented.

Other cues to double vs single accent in BGW almost certainly include segmental cues, such as the strength of the onset consonant in the second syllable (see Chapter 4, §4.6.4.2). Consider the spectrograms for the single-accented utterance na-ngamed and double-accented na-ngamed (Figures 3.5 and 3.6), both from a single text (NAMALADJ) by Kuninjku speaker MK2. The relative shortness of the velar nasal segment in Figure 3.5 seems to be a contributing factor to this analyst’s perception that the syllable nga is metrically weak.

Compare also the two tokens of bi-nguneng (3/3a-eatPP, ‘he ate him’) in Figures 3.7 (single accent) and 3.8 (double accent). These tokens are both by the Kuninjku speaker MK2. Note that in both tokens, the second vowel /u/ retains its full quality. There is also stretching of the second vowel in the double-accented token, which suggests a somewhat emphatic pronunciation. The onset consonant [ŋ] is considerably lengthened in the double-accented token, as a percentage of the word duration and the syllable duration, when compared with two tokens in which the syllable nga is unaccented.
Figure 3.5:
Wideband spectrogram of a single-accented token of na-ngamed (corresponding to Sound file 3.13, speaker MK2)

Figure 3.6:
Wideband spectrogram of a double-accented token of na-ngamed, corresponding to sound file 3.18 (speaker MK2)
Figure 3.7: Wideband spectrogram of a single-accented, IP-unique token of *bi-nguneng* (Sound file 3.19, speaker MK2)

Figure 3.8: Double-accented, IP-final token of *bi-nguneng=wanjh* (Sound file 3.20, speaker MK2)
The following are examples of adjacent accented heads of feet, drawn from the Kuninjku dialect. The interpretation of F0 traces in terms of accent patterns is the subject of more detailed investigation in Chapter 5.

Example 3.5:

OUTPUT: [kan][weybu] ‘2/1-giveIMP’ ‘Give it to me’ (Kuninjku)

(1) Initial constituency assignment:

1 (* (*  
0 [kan][weybu]

(2) Accent is assigned to both the leftmost foot and the final foot:

2 (* (*  
1 (* (*  
0 [kan][weybu]

Sound file 3.21: Intonation-phrase unique token of /gan weibo/ ([gan weibo])

Figure 3.9: Double-accented, intonation-phrase unique token of kan-weybu

H* H* Lp-%
kan-weybu
In this example, the F0 trace rises from the onset of the first accented syllable, [gan], to a medial peak, and begins falling at the onset of the second accented syllable, [wɛ1], to a low tone target (associated with the upcoming prosodic boundary) at the end of the syllable. This alignment of the onset of the fall at or near the onset of the second accented syllable is typical of double-accented tokens in BGW.

Example 3.6:

Output: [a][keb][kan]  ‘1-nose-carry.NP’ (meaning, ‘I take (a dog) hunting’) (Kuninku)

(1) Initial constituency assignment:

1  (*  (*  (*
0  [a][keb][kan]

(2) Accent is assigned to the leftmost and the rightmost accentable foot\(^\text{19}\)

2  (*  (*
1  (*  (*  (*
0  [a][keb][kan]

(3) Post-Accent Metrical Head Deletion is applied, then Stray Syllable Adjunction refoots the de-footed syllable, hence:

2  (*  (*
1  (*  (*
0  [a] [keb] [kan]

Sound file 3.22: IP-unique token of /age\_bgan/ ([age\_pgan])

\(^{19}\) The final foot is a final monosyllable, and therefore generally unaccentable; refer to § 3.5.5.
Another example from Kuninjku is:

\[\text{[ben][bengkang]}\]  \text{‘3P/3pl-know’} \quad \text{‘He knew them’}

### 3.5.3 Non-adjacent accents in polymorphemic words

3.5.3.1 Phonetic realisation of contours with non-adjacent accents

Accents with unaccented syllables between them form a hat pattern (Collier, t’Hart and Cohen, 1990; Cohen and t’Hart, 1967; Chapter 2, this dissertation). Hat pattern contours occur in many other stress accent languages, such as English, Dutch and German. In BGW, however, the hat pattern often spans a single, polymorphemic word.

The high F0 target reached for the first accent in the word is generally maintained up to the final accent; the F0 then begins to fall through the final accented syllable (see Figures 3.11 - 3.13 below).\(^{20}\)

The general lack of F0 movement between an initial and final accent means that an intervening metrically strong syllable, even if it sounds prominent, will usually not be

\(^{20}\) See Chapter 5 for a more detailed analysis of the phonetic realisation of pitch accents within the hat pattern.
marked as accented if the F0 trace remains steady across it.21 This is because, in this study, a turning point or elbow in the F0 trace is considered to be the most important indicator of a pitch accent, there being, at present, no other method of verifying the presence of an accent in BGW, such as on the basis of pragmatics. See Chapter 5 for a full discussion of the analysis of accent location in terms of ‘turning points’ in the F0 contour.

Example 3.7: Hat pattern across a heptamorphemic verbal word

![Hat pattern graph]

Figure 3.11: Hat pattern across the verbal word *bani-wel(e)ng-bepbe-marne-yaw-bu-rriny* (MM, speaker HD)

Gloss: 3uaP-then-separately-BEN-child-fight-each.other-PP
Translation: ‘Then they both fought each other over the child.’

Sound file 3.23: IP-unique token of /banιwelєngbepbєmαnєjaubуrin]/ ([banιwelєngbepbєmαnєjaubуrin ])

21 It might be objected that RMS amplitude could, in the absence of F0 movement, be used as a diagnostic for accent. However, RMS amplitude is not a consistent paradigmatic correlate of accent in Kuninjku (see Chapter 4, §4.6.2). Also, to argue in this manner is effectively to confuse levels of analysis. A pitch accent essentially corresponds to a tone on the autosegmental tone tier. As such, it is logically independent from the other forms of phonetic prominence which may or may not accompany it.
Examples 3.8 - 3.9 provide further examples of the hat pattern in BGW. They also illustrate how morphemes of different word classes behave in the same manner in relation to the assignment of accent, as might be expected in a language in which the relationship between accent and morphemes is not direct (i.e. diacritically marked in the lexicon, and therefore potentially idiosyncratic), but is mediated by the metrical structure regularly constructed over morphemes.

Example 3.8: Verbal trimorphemic word with hat pattern

```
OUTPUT: [ngarri][yauh][maknan] ‘1a-again-take.a.lookNP’ ‘We’ll try looking at one more place’ (Gun-Djeihmi)
```

```
2    (*)                    (*)
1    (*)                    (*)
0    [ngarri]-[yauh][maknan]
```

Sound file 3.24: Utterance-unique token of /ŋarijau?magnan / ([ŋarijau?maknan])

![Figure 3.12: Hat pattern in Gun-djeihmi (across ngarri-yauh-maknan).](image)

Nominal words pattern in the same manner, with transitional high F0 between the initial and final accented syllables. The following is an example of a hat pattern across a bimorphemic nominal word:
Example 3.9: Nominal bimorphemic word with hat pattern

OUTPUT: [detj]mak][duninj]  ‘hero-proper’  (MM)

Sound file 3.25: Utterance-medial token of /dejmagdunin/  (/dec mak dunin/)

Figure 3.13: Hat pattern across detjmak-dunin

The F0 trace shows a rise to the accent-related high tone target on the first syllable, [de c], followed by a section across the syllable [mak] where the F0 dips slightly toward the end of the syllable, possibly due to the perturbing effect of the voiceless velar stop, followed by a quite steep fall beginning close to the onset of the vowel in the second accented syllable [d U], to a low F0 target that is reached by the onset of the final vowel in the word.

In contrast to the preceding three examples, Figure 3.14 (Example 3.10) shows a single accent assigned to the first foot of a trimorphemic word. The F0 contour which results is a long fall rather than a hat pattern, and the heads of the medial and final feet do not sound as rhythmically prominent as the head of the initial foot (cf. Chapter 2, §2.3.1-2).
Example 3.10

OUTPUT: [bene][marne][yimeng] ‘3uaPAST - BEN - say.PP’ (Kuninjku)

(1) Initial constituency assignment:

\[
\begin{array}{ccc}
1 & (* & (* & (* \\
0 & [bene][marne][yimeng] \\
\end{array}
\]

(2) Accent is assigned to the leftmost foot:

\[
\begin{array}{ccc}
2 & (* & (*) & (*) \\
1 & (* & (*) & (*) \\
0 & [bene][marne][yimeng] \\
\end{array}
\]

Sound file 3.26: Utterance-unique token of /bene marne yimeng / [bene marne yimeng]

Figure 3.14: Single accent F0 pattern across bene-marne-yimeng

There are very few examples in the Kuninjku corpus of a word bearing an accent on each of its three metrically strong syllables. In Example 3.11, the medial accent is upstepped (has a higher F0 target) relative to the preceding accent and is therefore discernable as an accent.
Example 3.11

OUTPUT: [rawoyh][rdurddu][dadjeng] ‘3P-again-heart-cut.into.piecesPP’
(Kuninjku)


Figure 3.15: IP-unique, triple-accented token of rawoyh-rdurddu-dadjeng

The F0 trace shows a rise to an accent peak on the second syllable of the initial foot (a late peak accent), followed by another rise of approx. 25 Hz (obscured by the discontinuity in the trace caused by the glottal stop), which I tentatively interpret as indicating an accent peak on the first syllable of the medial foot. This is followed by another period of perturbation in the trace (the F0 dips down into and rises out of the voiced retroflex stop), with the final accent-related fall beginning on the penultimate syllable. The F0 trace is not tracked across the final syllable due to creaky voice caused by very low F0.
3.5.4 Variable accent assignment to metrically strong syllables within the word: minimal and near-minimal pairs

The presence or absence of an accent on a given syllable in a word indexes the underlying metrical structure. This metrical structure is sometimes reinforced by accent (e.g. the syllable [gu] in na-kudji=wanjh (MA-one=then, ‘one (of them) then’), in Figure 3.16 below) and at other times obscured in the surface metrical structure (e.g. the same syllable in na-kudji, this time unaccented, also in Figure 3.16). Note that the F0 remains high across the syllable [gu] in na-kudji=wanjh, while in na-kudji, the F0 is falling throughout this syllable after reaching a peak on the syllable na-. This fall indicates a transition between the preceding peak and the following low target (at the end of the word), without any accentual target on [gu].

Example 3.12 illustrates the steps by which the underlying final foot /gUÔI/ in na-kudji is defooted and refooted as a single surface metrical foot together with [na], according to the processes of Post-Accent Metrical Head deletion and Stray Syllable Adjunction outlined in section 3.5.1. The new foot-medial status of the velar stop is segmentally cued by its lenition to a velar approximant (refer to sound file 3.28).

Example 3.12

\[
\begin{align*}
\text{1} & \quad (*) (*) \quad \rightarrow \quad \text{2} & \quad (*) (*) \quad \rightarrow \quad \text{2} & \quad (* *) \\
[\text{na}] [\text{kudji}] & \quad \rightarrow \quad [\text{na}] [\text{kudji}] & \quad \rightarrow \quad [\text{na}] [\text{kudji}]
\end{align*}
\]

The metrical structure of na-kudji=wanjh can be represented as follows:

\[
\begin{align*}
\text{2} & \quad (*) (*) \\
\text{1} & \quad (* *)(*) \\
[\text{na}] [\text{kudji}] = [\text{wanjh}] & \quad \text{Gloss: I-one=then} \\
& \quad \text{Translation: ‘That one, then.’}
\end{align*}
\]

Sound file 3.28: Intonation phrase-unique token of /nagûjiwaǐɲ?/ ([nagûjiwaǐɲ?]) and utterance-initial token of /nagûji/ ([nauώji])
The following two tokens of *ngal-dah-daluk* (II-REDUP-woman, ‘(the) women’) in Figures 3.17 and 3.18 are a minimal pair, sharing the same underlying metrical structure, but a quite different rhythmic surface structure, due to the different assignment of accent to feet in each token.

There is a clearly audible difference in rhythm between the two tokens (compare sound files 3.29 and 3.30), in spite of the similarity of the F0 traces, the accompanying RMS amplitude traces, and the relative durations of the syllables in each. In the second token of *ngal-dah-daluk*, the elision of the coda [l] of [al] adds to the percept that this syllable is metrically weak. The dropping of the initial velar stop is a frequent and distinct process in some dialects of BGW, and is independent of the accentual status of the initial syllable.

It was not possible to discern any conditioning factors for the differing patterns of accentuation in the discourse context of each token.
Example 3.13

\[
\text{OUTPUT: } \text{[ngal][dah][daluk]} \quad \text{‘noun class (fem.)-REDUP-woman’ ‘the women’}
\]

(1) Initial constituency assignment:

\[
\begin{array}{c}
1 & (* & (* & (*) \\
0 & \text{[ngal][dah][daluk]}
\end{array}
\]

(2) Accent is assigned to the leftmost and the rightmost foot:

\[
\begin{array}{c}
2 & (* & (*) \\
1 & (* & (*) \\
0 & \text{[ngal][dah][daluk]}
\end{array}
\]

(3) Post-Accent Metrical Head Deletion is applied, then Stray Syllable Adjunction refoots the de-footed syllable, hence:

\[
\begin{array}{c}
2 & (*) \\
1 & (*) \\
0 & \text{[ngal][dah][daluk]}
\end{array}
\]


\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|c|c|}
\hline
\textbf{tones} & \textbf{H*} & \textbf{Lp-%} & \textbf{H*} & \textbf{L-%} \\
\hline
\textbf{words} & \text{be-h-borroy} & & \text{al-dah-daluk} & \\
\hline
\textbf{sylls} & be & nek & boi & ray & ngal & dah & de & dah \\
\hline
\textbf{breaks} & & & & & & & & \\
\hline
\end{tabular}
\end{table}

\textbf{Figure 3.17:} IP-unique, double-accented token of (ng)al-dah-daluk
Example 3.14

OUTPUT: [ngal][dah][daluk] ‘noun class (fem.)-REDUP-woman’ ‘the women’

(1) Initial constituency assignment:

1  (* (* (*)
0  [ngal][dah][daluk]

(2) Accent is assigned to the medial foot:

2  (*)
1  (* (*) (*)
0  [ngal][dah][daluk]

(3) Pre- and Post-Accent Metrical Head Deletion is applied, then Stray Syllable Adjunction refoots the de-footed syllables after the accent, hence:

2  (*)
1  (*)
0  ngal[dah][daluk]

Sound file 3.30: Utterance-final token of /nald a? dal u g/ ([ada?dal u k])

Figure 3.18: IP-initial token of (ng)al-dah-daluk with a single medial accent
3.5.5  *General unaccentability of word-final syllables*

The final syllable in a word will not receive accent, except if the word is emphasised, or final in an interrogative or imperative construction (see Sections 3.9 and 3.10). In these latter cases, metrical structure must often be induced in a syllable which is not underlingly strong.

Where the word consists of two underlying monosyllabic feet, only the first of which bears accent, the second foot will undergo Post-Accent Metrical Head Deletion and Stray Syllable Adjunction, producing a surface bisyllabic foot (Example 3.15).

**Example 3.15**

```
OUTPUT: [man][kung] ‘noun class (veg.) - honey’ (Kuninjku)
```

(1) Initial constituency assignment:

```
1  (*   (*
0  [man]-[kung]
```

(2) Accent is assigned to the leftmost foot:

```
2  (*
1  (*   (*
0  [man][kung]
```

(3) Post-Accent Metrical Head Deletion is applied, then Stray Syllable Adjunction refoots the de-footed syllable, hence:

```
2  (*
1  (*
0  [man][kung]
```

*Sound file 3.31:* Utterance-initial token of /mɑŋuŋ/ ([mɑŋuŋ])
The almost-linear falling shape of the F0 trace across the word man-kung and also the word bekkang, with a downstepped high accent (Figure 3.19), resembles the trace across the longer word bene-marne-yimeng in Figure 3.14, which also has an accent on the initial syllable. In each case, there is a direct transition between a high accent-related tone target and a low, boundary-related tone target.

Final syllables may sound ‘stressed’ in certain utterances due to the durational effects of utterance-final syllable lengthening, or the acoustic salience produced by an F0 fall across the final syllable at an intonational boundary. For example, in sound file 3.45, the final syllable of the word na-gimuk-gen sounds quite strongly prominent. There are, however, clear phonetic causes for this perception of prominence: the final syllable has undergone final lengthening, in addition to bearing a rising tone sequence (Lp H%). The lengthening in combination with the pitch movement gives rise to a percept of prominence on this syllable. This prominence is incidental and phonetic, however, not systematic and phonological, as accent is.

Discussing the ambiguous status of stress in Icelandic final syllables, Hayes (1995: 189) argues for the possibility that phonetic final lengthening gives the percept of slight stress in final position in Icelandic phrases; his perception that these final syllables are stressless in phrase-medial position lends support to this interpretation. Clearly, it is important to distinguish such incidental phonetic salience from phonological prosodic prominence. In BGW, this distinction is made by recourse to patterns of accentuation.
Metrically strong syllables in word-initial and final feet regularly bear pitch accents, while the final syllable of a word, even when it is underlyingly metrically strong, only does so under marked circumstances (of emphasis, and some non-declarative constructions: see sections 3.9 and 3.10).

The following are examples of Pre- and Post-Accent Metrical Head Deletion and final syllable extrametricality with respect to accent. Bold type indicates the accented syllables. When two accents are assigned to a word such as trimorphemic *dabu-gen-no*, the final accent will not associate with a final morpheme that is monosyllabic.

\[
\begin{align*}
[kun][dulk] & \quad \text{Gloss: IV-tree (Kuninjku): ‘tree’} \\
[bert][no][yi] & \quad \text{Gloss: tail-3POSS-ERG (MM): ‘using its tail, with its tail’} \\
[dabu][gen][no] & \quad \text{Gloss: egg-GEN-3POSS (MM): ‘gravid’} \\
[marlaworr][no][yi] & \quad \text{Gloss: leaf-3POSS-ERG (MM): ‘using a leaf, with a leaf’} \\
[al][yahwurt][yi] & \quad \text{Gloss: II-youngest-ERG (MM): ‘the youngest (ERG)’} \\
[kan][nah][nan] & \quad \text{Gloss: 2/1-REDUP-seeNP (Kuninjku): ‘you’re watching me’} \\
[a][keb][kan] & \quad \text{Gloss: 1/3-take.dog.huntingNP: ‘I’m taking a dog out hunting’} \\
\end{align*}
\]

Further examples of unaccented final syllables include:

\[
\begin{align*}
[barri][ni] & \quad \text{Gloss: 3aP-sit (MM): ‘they sat’} \\
[dabu][no] & \quad \text{Gloss: egg-3POSS. (MM): ‘egg’} \\
\end{align*}
\]

3.6 An effect of syllable weight on the location of accent

In nominal and verbal roots which are longer than two syllables, and have an initial light syllable followed by a closed syllable, the closed syllable may initiate a new foot. This results in the left foot boundary associated with the root morpheme being effectively moved one syllable to the right in the surface metrical structure, relative to the underlying structure (see Examples 3.16 and 3.17).
Example 3.16

OUTPUT: [nga][wurlebme] ‘1-swim.NP’ (Kuninjku)

(1) Initial constituency assignment:

```
1 (* (*
0 [nga][wurlebme]
```

(2) An additional left foot boundary is added before the heavy syllable:

```
1 (* (* (*
0 [nga][wurlebme]
```

(3) Accent is assigned to the initial and the final foot:

```
2 (* (*
1 (* (* (*
0 [nga][wurlebme]
```

(4) Post-Accent Metrical Head Deletion is applied, then Stray Syllable Adjunction refoots the de-footed syllable, hence:

```
2 (* (*
1 (* (* (*
0 [nga][wurlebme]
```

*Sound file 3.32: Utterance-initial token, /ŋawə[ɛbmə/ ([ŋawə[ɛpmə])

A similar pattern of accentuation is observed in the following trisyllabic nominal root. Again, the association of a pitch accent with the syllable in question provides evidence for the onset of a new foot at that syllable’s left edge.
Example 3.17

OUTPUT: [ngal][ngarelyi] ‘long-necked tortoise’ (Kuninjku)

(1) Initial constituency assignment:

1 (* (*
0 [ngal][ngarelyi]

(2) Restructuring inserts a left foot bracket before the heavy syllable:

1 (* (* (*
0 [ngal][ngarelyi]

(3) Accent is assigned to the heads of the leftmost and rightmost feet:

2 (* (* (*
1 (* (* (*
0 [ngal][ngarelyi]

(4) Pre/Post-Accent Metrical Head Deletion prosodically demotes the syllable /ŋa/, which is then refooted with the preceding metrical head, according to Stray Syllable Adjunction:

2 (* (* (*
1 (* (* (*
0 [ngal][ngarelyi]

Sound file 3.33: Utterance-unique token, /ŋaŋaŋaŋi/ [ŋaŋaŋaŋi]

In both Figures 3.20 and 3.21, the F0 trace forms a clear hat pattern, extending a short plateau between the accent-related high tone target reached at the end of the first syllable and a second high tone target associated with the penultimate syllable.
Figure 3.20: Accent on the closed second syllable of the root in *nga-wurlebme*

Figure 3.21: Accent on the closed second syllable of the root in *ngal-ngarelyi*

Other words displaying the same pattern of non-root-initial accent include:

- [birri][wurlebmeng]  ‘they swam’ (Kuninjku, speaker MK)
- [ngal][yabokwarre]  ‘your sister’ (triangular kin term) (Kuninjku, speaker MK)
- [na][dabbo]kwarre]  ‘the old man’ (Kuninjku)
- [borleh][borle]dme]  ‘turn around (REDUP)’ (Kuninjku, speaker MK)
- [na][gimuk][gen]  ‘big ones’ (MM, speaker PB)
- [nguddange][kah]  Gloss: yours-ALL: ‘to yours’ (Kuninjku, speaker MK)
The constraint on the alignment of the left edge of the morpheme with the left edge of a foot is violated once for every root in the surface metrical structure. Note, however, that the maximal distance the left foot boundary ever occurs from the morpheme boundary is a single syllable.

In order to argue that the metrical head on the second syllable is additional to the underlying metrical structure computed from the morphological structure, it is necessary to produce evidence that the original morpheme-edge-to-foot mapping remains present. Example 3.18, in which both the initial open syllable and the second, closed syllable are accented, constitutes tentative evidence that this is so. Example 3.18 illustrates that the underlying metrical structure as derived from the morpheme structure is still required in order to explain the attested accent patterns: the morpheme-initial open syllable [mo] is accented as well as the closed second syllable. This accent pattern suggests the reality of the metrical structure represented at the second stage in the derivation of the surface structure, at which an additional metrical head is added to the original metrical structure.

**Example 3.18**

```
OUTPUT: [modjarrkki] ‘freshwater crocodile’ (Kuninjku)
```

(1) Initial constituency assignment:

```
1  (*
0  [modjarrkki]
```

(2) Restructuring inserts a left foot bracket before the heavy syllable when the first syllable of the morpheme is light:

```
1  (* (*
0  [modjarrkki]
```
(3) Unusually, accent is assigned to the head of both the initial and the new foot:

\[
\begin{array}{ll}
2 & (* (*) \\
1 & (* (*) \\
0 & [modjarrkki]
\end{array}
\]

*Sound file 3.34: Utterance-unique token, /mɔjarki/ ([mɔjarki])*

The context of this token is that the speaker is introducing this particular name for the freshwater crocodile into the conversation for the first time. This word, the Gundjeihmi/Kune name for the crocodile (Garde (in prep.)), is the one the speaker has been looking for, having just introduced the referent with another Kuninjku word for the reptile, *kumoken*. Since it is apparently the speaker’s intention that the word she provides should replace the other word, it appears that *modjarrkki* is spoken with narrow focus. Section 3.9 provides other examples of accentuation patterns used in the production of emphasis.

![Figure 3.22: Accent on the initial open syllable and second closed syllable of *modjarrkki*](image_url)
3.7 The special status of the penultimate syllable in Manyallaluk Mayali

In Manyallaluk Mayali, the penultimate syllable of a root (or root + TAM sequence) has a special status in relation to stress/accent. A new foot onset is optionally constructed at the left edge of the penultimate syllable, in morphemes where that syllable is metrically weak according to the metrical structure assignment algorithms.

Evidence for this additional metrical head comes primarily from patterns in the F0 trace associated with pitch accent. Evidence for the retention of the original metrical structure derived on the basis of morpheme structure comes from tokens showing accent both on the penultimate syllable and the preceding morpheme-initial syllable, where the left edge of the penultimate syllable does not coincide with the left edge of a morpheme (see Example 3.22).

Examples 3.19 to 3.21 illustrate that only this additional assumption – that the penultimate syllable edge may begin a new foot – is needed in order to obtain the outputs which occur in Manyallaluk Mayali.

Example 3.19

| OUTPUT: [barri][bepbe][yoy]22 ‘they lay separately’ (MM) |

(1) Metrical constituency is assigned first in accordance with the Alignment Constraint and taking into account the presence of any cohering morphemes:

1  (*  (  ( (*
0  [barri][bepbe][yoy]

(2) An additional foot boundary is inserted at the left edge of the penultimate syllable:

1  (*  (  (  ( (*
0  [barri][bepbe][yoy]

22 The orthographic sequence ‘pb’ in the morpheme bepbe corresponds to a stop cluster, not a long stop. The same orthographic sequence is unfortunately used in the MM orthography to indicate stop clusters and long stops (refer to Table A.3).
(3) Accent is assigned to the leftmost and the rightmost accentable feet (the final, monosyllabic foot, which is the stem in this example, rejects accent, as usual):

\[
\begin{array}{c}
2 \quad (* \quad (* \\
1 \quad (* \quad (* \quad (* \\
0 \quad [\text{barri}][\text{bepbe}][\text{yoy}]
\end{array}
\]

(4) Pre/Post-Metrical Head Deletion deletes the stress of syllables adjacent to accented syllables, and Stray Syllable Adjunction carries out refooting:

\[
\begin{array}{c}
2 \quad (* \quad (* \\
1 \quad (* \\
0 \quad [\text{barri}][\text{bepbe}][\text{yoy}]
\end{array}
\]

\textit{Sound file 3.35: Utterance-unique token, /ba\textit{ri}b\textit{e}b\textit{e}j\textit{e} / ([ba\textit{ri}b\textit{e}p\textit{be}j\textit{e}])}

\textbf{Example 3.20}

\begin{center}
\begin{tabular}{|c|}
\hline
\textbf{OUTPUT:} [ba]yerrgani & ‘he/she/it was sitting down’ (MM: speaker MK1) \\
\hline
\end{tabular}
\end{center}

(1) Metrical constituency is assigned first in accordance with the Alignment Constraint and taking into account the presence of any cohering morphemes:

\[
\begin{array}{c}
1 \quad (* \quad (* \\
0 \quad [ba][yerrgani]
\end{array}
\]

(2) An additional foot boundary is inserted at the left edge of the penultimate syllable:

\[
\begin{array}{c}
1 \quad (* \quad (* \quad (* \\
0 \quad [ba][yerrgani]
\end{array}
\]

(3) Accent is assigned to the leftmost, and also the rightmost, accentable foot, corresponding to the stem:

\[
\begin{array}{c}
2 \quad (* \quad (* \\
1 \quad (* \quad (* \\
0 \quad [ba][yerrgani]
\end{array}
\]
(4) Pre/Post-Metrical Head Deletion deletes the stress of syllables adjacent to accented syllables, and Stray Syllable Adjunction carries out refooting:

\[
\begin{align*}
\text{2} & \quad (*) \quad (*) \\
\text{1} & \quad (*) \quad (*) \\
\text{0} & \quad [\text{ba}][\text{yergani}]
\end{align*}
\]

\textit{Sound file 3.36:} Utterance-unique token, /\textit{bajergani} / (/[\text{ba}e\text{r}gani ])

The F0 trace for \textit{barri-bepbe-yoy} in Figure 3.23 shows an initial high-onset accent, after which the F0 remains fairly level, up to the second accented syllable, [bep]. The F0 falls steeply across this syllable to a following low target. Figure 3.24 shows a typical hat pattern, with the plateau extending across the initial syllable of the root to the second accented syllable, the penultimate, across which the F0 begins to fall (at around the vowel onset).

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure3.23.png}
\caption{Token of \textit{barri-bepbe-yoy} illustrating penultimate accent in Manyallaluk Mayali}
\end{figure}
Other examples of the same process include:

[barri][gep][dukgan] \(^\text{23}\)  
Gloss: 3aP-snout/jaw-tie.up.PI: ‘they used to tie up the jaws  
of the freshwater crocodile’

*Sound file 3.37: IP-initial token of /bariɡebduːkani/ ([bariɡepduːkani])*

[ba][bawoni]  
Gloss: 3P-leave.PI: ‘they used to leave it’

*Sound file 3.38: IP-initial token of /babaʊ̃i/*

[barri][mirnde][di] \(^\text{24}\)  
Gloss: 3aP-many-stand: ‘There were many of them there’

*Sound file 3.39: IP-medial token of /banimirnde di/ ([banimirnde di])*

[ga][gojje][yo]  
Gloss: 3-sleep.NP: ‘He/she/it is sleeping’

*Sound file 3.40: IP-final token of /gaŋojojje yo/ ([gaŋojojje yo])*

---

\(^\text{23}\) The orthographic sequence ‘kg’ in this MM word corresponds to a single phonemic long stop (/k:/), which is syllabified as the onset of the following syllable, in accord with the Onset First principle. The root-initial syllable is therefore /du/. It is an unfortunate feature of the current MM orthography that it does not distinguish phonemic long stops from stop clusters; see, for example, *barri-hepe-yoy* (footnote 18, this chapter). In this word, the orthographic sequence ‘pb’ corresponds to a stop cluster /bb/ ([pb]), syllabified as a coda and an onset. It does not correspond to a single long stop /p:/.

\(^\text{24}\) In Evans (in press), the morphemes *mirnde* ‘many’ and *bule*, ‘black’ are analysed as lexically accented on the second syllable (*mirnde*, *bule*). In the two examples provided by Evans from the Gun-Djeihmi dialect, the *de* and *le* syllables are also penultimate in the word (*gabarri-mirnde-rrit, arri-bulet-rrit*). I have only one digitised utterance with the morpheme *mirnde*, from MM (given above), and in this utterance the accented syllable is penultimate. In the absence of any other evidence for lexical accent elsewhere in the dialects examined in this study, I analyse the accent on this token of the morpheme as an instance of the more general tendency to accent the penultimate syllable in MM, rather than as evidence for lexical accent.
Example 3.21

OUTPUT: [darrgid][no] ‘alive’ (MM)

(1) Metrical constituency is assigned on the basis of the morpheme boundaries:

1   (*       (*
0   [darrgid][no]

(2) An additional foot boundary is inserted at the left edge of the penultimate syllable:

1   (*       (*       (*
0   [darrgid][no]

(3) Accent is assigned to the leftmost, and also the rightmost, accentable foot (the final, monosyllabic foot rejects accent):

2       (*       (*
1       (*       (*       (*
0   [darrgid][no]

(4) Post-Accent Metrical Head Deletion deletes the stress of the final syllable:

2       (*       (*
1       (*       (*
0   [darrgid][no]

Sound file 3.41: Utterance-final and -initial tokens of /darrgidno/ ([daɾɡidno])
As mentioned in section 3.5, it is conceivable that in phrase-final position, a word might gain an additional accent not present in non-final tokens – a kind of ‘sentence accent’. Example 3.21 provides evidence, incidentally, that double accentuation is not conditioned by final position in the intonational phrase. *Darrgid-no* retains its double accent both in isolation (intonation phrase-final position) (the first token in Figure 3.25) and in initial position in an intonation phrase (the second token).

Other double-accented examples include:

\[\text{[barri][jan.gayhmi]}\] 
Gloss: 3aP-cheer.PI: ‘They were cheering’

*Sound file 3.42:* Utterance-final token of /baɾiˈjɑŋaɪʔmɪ/ ([baɾiˈjɑŋaɪʔmɪ])

\[\text{yi[mim][dapgey]}\] 
Gloss: 2/3-eye-cover.PI: ‘You would cover their eyes’

*Sound file 3.43:* Utterance-unique token of /jɪmɪmdaˈbɛɡɛjɪ/ ([jɪmɪmdaˈbɛɡɛjɪ])

\[\text{[datbe][yih]}\] 
Gloss: king.brown.snake-ERG: ‘(The) king brown snake (did it)’
3.8 Pitch accent ‘shift’ attributable to changes in metrical structure (addition of metrical elements)

Since pitch accent location is dependent on underlying metrical structure, ‘shifts’ in accent location may be related to variations in metrical structure. The following examples illustrate a ‘shift’ in accent location enabled by a change in the metrical environment of the morpheme -gimuk, ‘big’. As noted in section 3.2.2, such ‘shifts’ are an important diagnostic for a stress accent language. Example 3.22 shows an utterance in which accent is assigned to the initial syllable only of the word na-gimuk. The syllable muk, being word-final, is not accented. The second syllable, gi, is the onset of a new morpheme and therefore a new foot in the underlying metrical structure. It has the potential to be accented, but is not accented in this utterance. In Example 3.23, the syllable muk of na-gimuk is followed by the genitive suffix, gen, and is accented. Since the syllable [muk] is non-final in the word in this instance, and heavy (also penultimate), it can optionally form the head of a new foot. As seen in section 3.6, the relative weight of a root-initial CV syllable compared to a second, CVC syllable may render the second, non-morpheme-initial syllable accentable. There is also an optional pattern of penultimate syllable accent in MM, as described in section 3.7. There is nothing in this example which allows us to decide which of the two accounts is applicable in this instance.

Example 3.22

<table>
<thead>
<tr>
<th>OUTPUT: [na][gimuk]</th>
<th>‘noun class (masc.) - big’ (MM)</th>
</tr>
</thead>
</table>

(1) Initial constituency assignment:

1 (* (*
0 [na][gimuk]

(2) Accent is assigned to the first foot (this accent rises to a delayed (late) peak, on the post-stress syllable: see Chapter 5, 5.4.7, for a discussion of late peak accents)

2 (*
1 (* (*
0 [na][gimuk] |
(3) Post-Accent Metrical Head Deletion and Stray Syllable Adjunction apply:

2 (*
1 (*
0 [na][gimuk]

Sound file 3.44: Utterance-unique token, / nagimuk / ([nagimuk'])

Example 3.23

| OUTPUT: [na][gimuk][gen] | ‘noun class (masc.) - big- GEN’ (MM) |
---|---|

(1) Initial constituency assignment:

1 (* (* (*
0 [na][gimuk][gen]

(2) The syllable [muk] forms the head of a new foot.

1 (* (* (* (*
0 [na][gimuk][gen]

(3) Accent is assigned to the initial and final accentable feet:

2 (* (*
1 (* (* (* (*
0 [na][gimuk][gen]

(4) Pre/Post-Accent Metrical Head Deletion applies to delete the stress of the syllables [gi] and [gen], giving the observed rhythmic output.

2 (* (*
1 (* (*
0 [na][gimuk][gen]

Sound file 3.45: Utterance-final token of / nagimuugen / ([nagimuugen])

Figures 3.26 and 3.27 are the F0 traces for na-gimuk and na-gimuk-gen. Figure 3.26 is an instance of an ambiguous F0 trace which requires careful interpretation (and may remain ambiguous even when interpreted with care). Both the morpheme na and the initial syllable of the morpheme gimuk are metrical heads; either might bear a pitch accent. The syllable [gi] is audibly higher in pitch than the preceding syllable, and might therefore be
interpreted as accented; however, I hear the first syllable as the most rhythmically prominent in this instance. ‘Late peak’ accents, in which the F0 reaches a peak on the syllable after the one the accent is phonologically associated with, are not uncommon in phrase-initial positions (see Chapter 5, section 5.4.7.1). I have therefore interpreted this accent as a late peak accent.

In Figure 3.27, the first accent is also a late peak accent; after a slight dip in F0 across the [m] segment, the F0 begins to fall in the vicinity of the vowel onset in [muk], the second accented syllable.

Figure 3.26: IP-unique token of na-gimuk. The accent on na- has a late peak realized on gi-.
3.9 Morpheme-final emphatic accent

As discussed in section 3.5.5, the word-final syllable is generally unaccented in BGW. However, heavy emphasis may cause an exceptional additional accent to be assigned to the final syllable of a polysyllabic morpheme. This accent induces in that syllable the metrical structure it requires. Final-accented syllables in BGW are also considerably lengthened—impressionistically, to a greater extent than would be expected from preboundary lengthening alone.

Exceptional word- or morpheme-final accent associated with emphasis has been observed in three other Australian languages, genetically unrelated to BGW (see Chapter 1, section 1.3.5.5). Marsh (1969) describes word-final emphatic accent in Mantjiltjara; accent in Mantjiltjara usually falls on the initial syllable of the word (see footnote 15, Chapter 1). Nash cites Jagst (1975:44) as describing an “exclamatory affix” in Warlpiri, *wu*, “which puts an intonation peak on the final syllable of the word to which it attaches. Jagst (1975:41-44) otherwise records initial stress.” (Nash, 1986: 100, n.13) King (1994, also cited in Ladd, 1996: 131) has observed two tokens of emphatic final accent in Dyirbal, which has a single word-initial pitch accent under ordinary circumstances. Both tokens, *dada* (baby) and *wubu* (orphan), are bisyllabic, leading to two adjacent accents, as in the Kuninjku token *duruk*, illustrated below in Figure 3.28. Such double accentuation
is significant in both Dyirbal and Kuninjku because it is a phonologically marked production: the final syllable of the word is generally unstressed and the double-accented word is monomorphemic. It would therefore not be expected to bear more than one accent. In Dyirbal, the double-accent pattern is also marked because the accents are adjacent, thus violating the general pattern of alternating stresses in that language (King, 1994: 102).

Ladd (1996:131) suggests that a device of utterance-final emphatic accent on an otherwise unstressed syllable is not uncommon across languages. It has frequently been observed in English (e.g. Jones, 1956). Ladd (1996: 131) notes that it also occurs in Italian, where the scope of what is emphasised varies from the accented word to the entire utterance. As Ladd suggests, the effect of the final accent seems to arise, at least in part, from its markedness in relation to the constraints on the association of accents: “…we seem to be dealing with a general strategy for increasing the emotional content of the contour by suspending the normal constraints on tune-text association.” (1996:131) It would appear that this strategy is also being applied in BGW, as in Dyirbal. BGW has also conventionalised the use of utterance-final accent (as opposed to the morpheme-final accent discussed in this section, though the two often coincide), in some imperative and interrogative constructions. This is the subject of section 3.10 below.

Examples 3.24 to 3.28 illustrate emphatic final accent in Kuninjku and Manyallaluk Mayali nominals.

Example 3.24

| OUTPUT: [du][ruk] | ‘dog (emphatic)’ (Kuninjku) |

(1) Metrical constituency is assigned:

1  (*
0  [duruk]

(2) Accent is assigned, in this case to the final syllable of the word in addition to the head of the foot formed in (1). This requires a foot to be constructed on that final syllable (an asterisk added at Level 1):
Example 3.25

| OUTPUT: [na][wernwarre] | ‘old man (emphatic)’ (Kuninjku) |

(1) Metrical constituency is assigned:

1  *  *
0  [na][wernwarre]

(2) Accent is assigned, in this case to the final syllable of the word as well as to the head of the final foot. This requires another foot to be constructed on the final syllable.

2  (*  (*
1  (*  (*  (*
0  [na][wernwarre]

(3) Since the initial syllable is not accented in this case, Pre-Accent Metrical Head Deletion applies to remove the initial stress:

2  (*  *
1  (*  (*)
0  [na][wernwarre]

Sound file 3.46: IP-unique token of /duruk/ [duruk k]

Sound file 3.47: IP-unique token of /nawernwarre/
Figure 3.28: Token of *duruk* with final syllable accent

Figure 3.29: Double-accented token of *na-wernwarre* with final syllable accent
Example 3.26

| OUTPUT: [judubu] | ‘cooking stone (emphatic)’ (MM) |

(1) Metrical constituency is assigned:

\[
\begin{align*}
1 & (* \\
0 & [judubu]
\end{align*}
\]

(2) Accent is assigned to the initial and also the final syllable, necessitating the separate footing of the final syllable:

\[
\begin{align*}
2 & (* (* \\
1 & (* (* \\
0 & [judubu]
\end{align*}
\]

The speaker of this utterance is giving a Mayali substitute for a Kriol word used by another speaker (butbol, meaning ‘football’). The other speaker apologises (gen, ‘sorry’) and assents to using the Mayali word in place of the Kriol word, by repeating it – with initial accent only.

The emphatic final syllable accent in the two Kuninjku utterances was a simple high accent, H*; in this Manyallaluk Mayali example it is L+!H* (an L+H* accent with the H target lowered relative to the preceding accent). This difference may be simply incidental, since there are two attested examples of emphatic final syllable accent in Kuninjku, in which the L+H* accent is used (Figures 3.33 and 3.34).
Figure 3.30: Two tokens of judubu, with and without final syllable accent. Note that the fall following the final accent on the first token is not evident in the F0 trace, which is perturbed by breathiness toward the end of the final syllable.

Sound file 3.48: IP-unique, double-accented token of judubu with final syllable accent

Note the contrast in final RMS levels in each token of judubu in Figure 3.30. Relative RMS levels in each syllable in the word are indicated by the arrows. There is a clear drop-off in intensity on the final syllable in the repetition of the word, but not in the emphatic token. Thus, although “the general trend of declination in intensity in the sentence complicate[s] the use of intensity as a stress correlate” (Fant and Kruckenberg, 1993: 44), the production of a final emphatic syllable against the expected backdrop of declining pitch and intensity clearly renders that syllable all the more ‘marked’ phonetically.

The next example (Example 3.27) is particularly important in terms of clarifying the phonological association of the emphatic accent. It shows that the emphatic final accent does not simply associate with the final syllable of the last word in an intonational phrase or utterance, but rather with the last syllable of the emphasised morpheme itself. Kurlba-kenh is the only word in its intonational phrase and utterance. If emphatic accent were associated with the final syllable in the IP or the utterance, the accent would be associated with the syllable -kenh. Instead, kurlba-kenh, which glosses as ‘blood-GENITIVE’, receives an additional accent on the final syllable of the root morpheme.
The full utterance, *ngal-bu kabi-won, kurlba-kenh*, means ‘the one which he (or she) gives him (or her), for its blood’. In this context, *kurlba-kenh* serves as an expansion, an addition of new information to what has been said.

**Example 3.27**

<table>
<thead>
<tr>
<th>Output: [kurlba][kenh]</th>
<th>‘for (its) blood (emphatic)’ (Kuninjku)</th>
</tr>
</thead>
</table>

(1) Metrical constituency is assigned:

1: (* (*
0: [kurlba][kenh]

(2) Accent is assigned. This requires another foot to be constructed on the final syllable of the morpheme, to support the extra accent:

2: (* (*)
1: (* (*) (*
0: [kurlba][kenh]

(3) Post-Accent Metrical Head Deletion and Stray Syllable Adjunction apply, giving the required output.

2: (* (*)
1: (* (*)
0: [kurlba][kenh]

*Sound file 3.49:* IP-unique token of /gu(bagen)?/ ([(gu)bagen?]), with morpheme-final accent on [ba]

**Example 3.28**

<table>
<thead>
<tr>
<th>Output: [ngudda][ngke]</th>
<th>‘yours (emphatic)’ (Kuninjku)</th>
</tr>
</thead>
</table>

(1) Metrical constituency is assigned:

1: (* (*
0: [ngudda]=[ngke]
(2) Accent is assigned to the leftmost foot, and an exceptional, emphatic accent is assigned to the final morpheme -ngke\(^{25}\), which is already a foot in the underlying metrical structure.

\[
\begin{array}{ccc}
2 & (*) & (*) \\
1 & (*) & (*) \\
0 & \text{[ngudda]=-[ngke]}
\end{array}
\]

The second person possessive pronoun -(ng)ke is syntactically a clitic in Kuninjku. Prosodically, however, it does not behave in a distinct manner from suffixes, such as -kenh in the above example, which are separately footed, in accord with their status as non-cohering morphemes. The word in this example is a question: ‘(Is it) YOURS?’ (ngudda=ngke glosses as ‘you=your’). To convey contrastive emphasis on ‘yours’, the clitic is accented.

\[\text{Sound file 3.50: IP-unique token of } /\text{ŋut:\textipa{a}ŋge}/ \text{, } nguddangke, \text{ with morpheme-final accent on } [\text{ge}]\]

The F0 trace in Figure 3.31 shows the accents on both the initial and the final syllables of the morpheme kurlba. The initial accent is a high-onset accent (without an initial rise through the accented syllable), followed by a steep fall in F0 across the second accented syllable, starting at the vowel onset, to a boundary-associated low tone target at the end of the syllable. The emphatic accent is indicated by an arrow in the F0 trace.

Figure 3.32 gives the F0 trace for the question Nguddangke? This is also a two-accent hat pattern (again with a high-onset initial accent); the second accent is cued by the fall in F0 across the final syllable, which begins shortly after the vowel onset.

\[\text{\textsuperscript{25} The initial velar nasal segment of } -ngke \text{ surfaces only when a vowel precedes the clitic, and syllabifies as a coda to that vowel (Nicholas Evans, pers. comm.).}\]
### Figure 3.31: Morpheme-final accent on kurlba, in kurlba-kenh

<table>
<thead>
<tr>
<th>tones</th>
<th>H*</th>
<th>‘H*’</th>
<th>Lp-%</th>
<th>H*</th>
<th>H*</th>
<th>Lp-%</th>
</tr>
</thead>
<tbody>
<tr>
<td>words</td>
<td>ngal-bu</td>
<td>kah-sim</td>
<td>kurlba-kenh</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sylls</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>breaks</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

### Figure 3.32: Morpheme-final accent on ke, in nguddangke

<table>
<thead>
<tr>
<th>tones</th>
<th>H*</th>
<th>‘H*’</th>
<th>Lp-%</th>
<th>H*</th>
<th>H*</th>
<th>Lp-%</th>
</tr>
</thead>
<tbody>
<tr>
<td>words</td>
<td>nguddangke</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>breaks</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

180
The following are further examples of additional final syllable accent on nominal roots in Kuninjku:

[nгарре]-[воненг], ‘our’ (an accent on the head of each underlying foot and additional final accent)

*Sound file 3.51: IP-unique token of /ŋarewòneŋ/*

[nga]-[мунгу], ‘I’m innocent!’ (an accent on the head of each underlying foot and additional final accent)

*Sound file 3.52: IP-initial token of /búrgjag/*

[burrkyak], ‘no!’ (accent on the head of the foot and the final syllable)

*Sound file 3.53: IP-unique token of /ŋut:a/*

Ideophones also tend to be accented on the final syllable, e.g.:

2 (* 1 (*)
0 джиррит ‘sound denoting tickling’ (Kuninjku)

2 (*) 1 (*)
0 джилурл ‘sound made when hitting the water to frighten crocodiles away’ (Kuninjku)26

Two examples from Kuninjku illustrate emphatic L+H* accent on the final (stem) syllable of verbs. The context of these examples is a conversation27 conducted over the telephone by two Kuninjku speakers, who are discussing the whereabouts of people known to them both. In the example shown in Figure 3.33, the speaker is referring to others not previously mentioned in the conversation, but mutually identifiable, and emphasising that they, too, have left (gone to Darwin). In the second example (Figure

26 Garde(ms.) Draft dictionary of Kuninjku.
27 Recorded with permission by Murray Garde, to whom thanks are due for the use of this and the other Kuninjku texts in my analysis.
the speaker is pressing home the point that the hearer and another companion should take Balang with him.

Figure 3.33:  
L+H* accent on a verb-final syllable, -wam (Kuninjku)

Transcription: namekke a-wohnan la nakkanj birri-wam
Gloss: MA.DEM. 1/3-seeNP and MA.IMM.PREV. 3a-goPP
Translation: ‘I see them – they’ve left.’

Sound file 3.54

Figure 3.34:  
L+H* accent on a verb-final syllable, -mang (Kuninjku)

Transcription: Balang nane ngune-mang
Gloss: [name] MA.DEM.
Translation: ‘You two take Balang.’

Sound file 3.55
3.10 Verb-final accent in WH-questions and imperative constructions in Manyallaluk Mayali

A pitch peak on the final syllable of the verbal word, generally preceded by a low tone target at or near the onset of the syllable, was recorded on many WH-questions and grammatically imperative constructions (those in which the verb root is conjugated in the imperative) in Manyallaluk Mayali. Cues which suggest the high F0 excursion is due to a pitch accent rather than a boundary tone include RMS levels, which would ordinarily decline quite sharply across the final syllable of an utterance, but instead remain high (final syllable RMS levels are indicated with an arrow in Figure 3.35 to 3.39); and generally, that the syllable is as rhythmically prominent as other accented syllables in the utterance. The final syllable bearing the accent is also considerably lengthened in these examples (refer to the syllable label tier in Figures 3.35 to 3.38). The accent is analysed as a bitonal high pitch accent with a leading low tone, L+H*, since a low target falls at or before the vowel onset and is followed rapidly by the rise to the peak, reached at a medial point in the final syllable (see Chapter 1, § 1.7.3.1).

Examples 3.29 and 3.30 illustrate WH-interrogative patterns, and Examples 3.31 and 3.32 illustrate imperatives.

Example 3.29 consists of the WH-question word, nyalegen, meaning ‘why, what for’, followed by the verbal word, nguni-burren, which is glossed as nguni- ‘you two’, the verb root bu- meaning ‘hit’, followed by the reciprocal-reflexive suffix -rr- and the TAM suffix -en, indicating present indicative tense and mood. The verb root and TAM suffix/reciprocal-reflexive suffix cohere into a single metrical foot.

Example 3.29

OUTPUT: [nyalegen] ## [nguni][burren] ‘Why are you two hitting each other?’
(Manyallaluk Mayali, speaker PB)

(1) Metrical constituency is assigned:

1 (* (*
0 [nguni][burren]
(2) Accent is assigned to the final syllable, inducing the required metrical structure:

\[
\begin{array}{cccc}
2 & * & * \\
1 & * & * & * \\
0 & [\text{nguni}][\text{burren}] \\
\end{array}
\]

(3) Pre-Accent Metrical Head Deletion and Stray Syllable Adjunction apply:

\[
\begin{array}{cccc}
2 & * & * \\
1 & * & * \\
0 & [\text{nguni}][\text{burren}] \\
\end{array}
\]

\textit{Sound file 3.56: Token of WH-question /nalegen \text{nuni-burren} / ([nalegen \text{nuni-burren}])}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure335.png}
\caption{WH-question \textit{nylegen nguni-burren} with accent on the final syllable}
\end{figure}

The F0 trace in Figure 3.35 shows an initial accent rising to a late peak on the second (post-stress) syllable of \textit{nylegen}, followed by a long, almost linear transition to a low tone target, reached at the vowel onset of the final syllable. The close temporal relationship between the alignment of the low tone target and the following high peak suggests the phonological relationship between the two targets that is indicated by the L+H* notation.

In Example 3.30 (Figure 3.36), the WH-question word \textit{nyale}, ‘what’, is followed by the verbal word \textit{yi-yawan}, beginning with the pronominal prefix \textit{yi}, ‘you (singular)’,
and the verb root + TAM ending, *yawa* + *n*, meaning ‘look for’. The word *yiman* means roughly ‘like this’; it is used in the context of providing an example of how something might be said, or done.

**Example 3.30**

<table>
<thead>
<tr>
<th>OUTPUT:</th>
<th>[nya]## [yi][yawan]</th>
<th>‘What are you looking for’</th>
<th>(MM)</th>
</tr>
</thead>
</table>

(1) Metrical constituency is assigned:

1  (*  (*

0  [yi][yawan]

(2) Accent is assigned to the final syllable only, inducing the required metrical structure:

2  (*

1  (*  (*  (*

0  [yi][yawan]

(3) Pre-Accent Metrical Head Deletion and Stray Syllable Adjunction apply:

2  (*

1  (*  (*

0  [yi][yawan]

**Sound file 3.57:** Token of WH-question /nale j i j a w a n/ ([nale j i j a w a n])

<table>
<thead>
<tr>
<th>tones</th>
<th>( L^* )</th>
<th>( L^* )</th>
<th>( L^* )</th>
<th>( L^* )</th>
</tr>
</thead>
<tbody>
<tr>
<td>nyale</td>
<td>yawan</td>
<td>yiman</td>
<td>yiman</td>
<td>yiman</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>words</th>
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</thead>
<tbody>
<tr>
<td>nyale</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>sylls</th>
</tr>
</thead>
<tbody>
<tr>
<td>y(a)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>breaks</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
</tr>
</tbody>
</table>

**Figure 3.36:** Two repetitions of the elicited WH-question *nyale yi-yawan?*, both with accent on the final syllable
In the single-word imperative utterance *ngurri-ray* (Example 3.31), the pronominal prefix *ngurri-* means ‘you all’ is followed by the imperative conjugation of the verb ‘to go’, -*ray*.

**Example 3.31**

| OUTPUT: [ngurri][ray] | ‘(All of you), go!’ (MM) |

(1) Metrical constituency is assigned; in this case, the final syllable is a foot in the underlying metrical structure:

1. (*   (*)
2. 0   [ngurri][ray]

(2)Accent is assigned to the initial and the final syllable, producing the output:

1. (*   (*)
2. 0   [ngurri][ray]

**Sound file 3.58:** IP-unique token of imperative utterance /ŋʊɾɪɾɪˈaɪ/ ([ŋʊɾɪɾɪˈaɪ])

**Figure 3.37:** Imperative *ngurri-ray*, with accent on the final syllable

In Example 3.32, the pronominal prefix *gan-* is a portmanteau morpheme meaning a second person singular subject affecting a first person singular object. The imperative form of the verb ‘to give’ is -*wo.*
Example 3.32

<table>
<thead>
<tr>
<th>OUTPUT: [gan][wo]</th>
<th>‘Give it to me!’ (MM)</th>
</tr>
</thead>
</table>

(1) Metrical constituency is assigned. Again, the final monosyllable is a foot in the underlying metrical structure:

1  (*  (*
0  [gan][wo]

(2) Accent is assigned to the initial and the final syllable, producing the output:

2  (*  (*
1  (*  (*
0  [gan][wo]

*Sound file 3.59: IP-unique token of the imperative / ganwo / ([kanwo])*

| tones | %H | H* | L+H* | Lp-5%
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
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<tbody>
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<tr>
<td>gloss</td>
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</tr>
<tr>
<td>misc</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Figure 3.38: Imperative gan-wo!, with accent on the final syllable

It is not clear at this point whether the L+H* tone is restricted to these constructions in Manyallaluk Mayali, or is also to be found in declarative utterances. It does not occur in any of the declarative utterances in that dialect analysed to date. L+H* accents are recorded in only two declarative utterances in Kuninjku, both illustrated in section 3.8. In both, it is used emphatically on the final syllable of a verbal word (see Figures 3.33 and 3.34). The use of L+H* in emphatic utterances in Kuninjku raises a question as to whether the use of the L+H* on a verb-final syllable in the Manyallaluk Mayali questions.
is in fact characteristic of interrogative and imperative constructions in this dialect, or whether it is not, rather, a correlate of emphasis more generally. It may be that the elicited WH-questions and imperatives recorded with this contour are particularly emphatic or ‘involved’ variants, with the corresponding intonation. Not all Manyallaluk Mayali questions or imperatives have word-final accent: in some, the final L+H* accent falls on the penultimate, and in a few other examples, the accent is a downstepped high accent (!H*).

3.11 The default accent position in Kuninjku and Manyallaluk Mayali

In the preceding sections of this chapter, I have examined the relationship between intonational accent and the metrical structure, which in general, organises the potential for accent. I have also discussed cases in which a conflicting principle overrides the regular patterns of association between metrically strong syllables and intonational accent, such that syllables which are underlyingly metrically weak may nonetheless be accented. These conflicting principles include effects of relative syllable weight, a preference in Manyallaluk Mayali for penultimate syllable prominence, and the production of emphasis.

In this section, I discuss the distribution of accent from another perspective. We have seen that polymorphemic words in BGW may have more than one accentable foot. Here, I examine what determines which feet in a polypedal word are accented, when one vs two accents are assigned to the word.

3.11.1 Relationship between pitch accent, culminativity and prosodic constituency

For some time, it has been assumed that words in stress accent languages, such as English, carry an intonational accent only on the ‘main stress’ syllable in the phonological word. The assumption that word-level culminative prominence conditions the placement of accent remains in accounts as recent as Kager (1999: 143), Turk and Sawusch (1997), and Goldsmith (1990:185). Turk and Sawusch state that “[t]he primary phonetic cue to accent, an F0 excursion, is typically aligned with respect to a single lexically stressed syllable.” The data presented in this chapter, which suggest that BGW words can bear more than one equally prominent accent (see §3.5.2), raise questions
about the universality of culminative prominence in a phonological word-level prosodic domain.

Hayes (1995: 25) notes that Tübatulabal and Yidiny have been claimed to have “multiple stresses” that are “equal in prominence” in long morphosyntactic words. However, Dixon (1977), cited in Evans (1995), suggests that morphosyntactic words in Yidiny, at least, may correspond to more than one phonological word, and there appear to be many sources of evidence, in addition to stress assignment, for the proposition: phonological word-final penultimate lengthening, final syllable deletion in the phonological word, and “the selection of case and tense allomorphs” (Evans, 1995: 749). In BGW, in contrast, there do not appear to be any independent sources of evidence for a division into two phonological words, in those morphosyntactic words which bear two accents of equal prominence.

Culminativity is sometimes expressed in terms of an end rule. In models of metrical phonology which use the metrical grid as a representational device, an end rule is a rule which assigns a higher metrical grid mark (representing a greater degree of prosodic prominence) to the head of a prosodic constituent that is right- or left- peripheral within the higher-level prosodic constituent. The end rule is therefore parameterised as Left or Right. The term ‘end rule’ is usually used in the relation to the Phonological Word level, where it indicates the location of a default single accent. According to Kager (1995), the end rule has the function of “assign[ing] main stress at Word layer by promoting a Foot layer mark to word prominence” (1995:384). However, the term is sometimes used in relation to the Intonational Phrase, where it indicates the nuclear accent in the phrase.

Recent studies have clearly demonstrated a tendency to place an ‘early accent’ on a secondary stressed syllable in English multipedal words (e.g. Shattuck-Hufnagel, Ostendorf and Ross, 1994). This creates an ambiguity in the interpretation of the word-level end rule as formulated by Kager (1995), and others. Insofar as two accents can be associated with a single word constituent, the surface culminativity of accent within the word (“main stress”) is violated.

The problem is in part that the intended interpretation of culminative prominence in the stress literature is often implicitly perceptual: “Dominance specifies whether to
select the rightmost ([End Rule (Foot)]), or leftmost ([End Rule (IP)]) landing site, which is to say, whether the leftmost or the rightmost stress has the greatest prominence in the word…” (Kager, 1995: 384; emphasis in original). However, culminativity cannot be used to refer simply to actual perceptual prominence. There can be considerable variability and ambiguity as to the location of the main perceptual prominence in the same word when in different prosodic contexts (such as when the word is double accented), yet one would not want to say that the location of primary lexical stress had changed (cf. Bolinger, 1986, cited in footnote 13, this chapter).

If the position of ‘main stress’ in a word is determined on the basis of the relative prominence of the ‘main stress’ syllable within the word, where prominence is defined perceptually, and more than one syllable in the word can bear a perceptually prominent pitch accent, then the ‘default’ or ‘primary’ stress location cannot be determined on the basis of perceptual prominence alone. Rather, the location of accent in words bearing a single accent needs to be examined, and any prosodic influences on the location of that accent filtered out, in order to determine a default location for accent.

A grid-based End Rule cannot directly represent the default location of a single culminative prominence (in the terminology of Ladd (1996), this would be a ‘primary accent’). If there is a default peripheral location of accent in the phonological word domain, it will only be evident from the actual placement of a single accent, in cases in which only one is assigned; or rather, by generalising across such instances. Default placement of a single intonational accent and culminative prosodic prominence at the word level are conflated in the end rule as described by Kager (1995).

With respect to BGW, generalising across the positions of a single accent in a word allows us to say, for example, that the word judubu (repeated as Figure 3.39 below) bears a default accent on ju and an additional, marked accent on bu. When repeated by the speaker to whom the utterance is addressed, the word bears only a single accent on the leftmost syllable. From this, we can extrapolate that an accent additional to the default is, at least in certain usages, associated with the word having extra emphasis. The nature of this emphasis, of course, needs further elucidation.
Similar issues arise in relation to the proposed association of a Prosodic Word constituent and pitch accent in Baker’s (1999) account of accentuation in Ngalakgan. Baker claims that the Prosodic Word level is defined by an accentual pitch prominence, aligned leftmost in the Prosodic Word. This definition is problematic insofar as the text itself provides examples in which a single Prosodic Word (a monomorphemic root divided into two metrical feet) bears double accent in a citation form (1999: 34)\(^{28}\). The Prosodic Word constituent is held to correspond, isomorphically, to a morphological category (MCat) in Ngalakgan; by this definition, these double-accented words cannot consist of two Prosodic Words. That double accentuation is nonetheless possible in these cases would seem to vitiate Baker’s claim that accent is culminative within the Prosodic Word in Ngalakgan\(^{29}\).

3.11.2 Positional frequencies of accent placement: Aims and method

In order to determine whether there is a position of accent which can be said to be ‘default’ in the morphosyntactic word in Kuninjku, positional frequencies of accent placement were determined for polymorphemic verbal and nominal words in the three

\(^{28}\) For example, the simple word /kurucatu/, meaning ‘olive python’, which is illustrated as bearing a pitch peak on the initial foot, and a higher pitch peak on the second foot (1999: 35).

\(^{29}\) The examples provided are not presented as bearing any special, e.g. emphatic, intonation.
Kuninjku narrative texts, CUCKOO, BILLABONG and NAMALADJ. Four Manyallaluk Mayali texts, PBTXT1-4, were also examined.

Verbs with monomorphemic roots (e.g. ‘bene-wam’) were omitted from the count, as were unprefixed polysyllabic roots (e.g. ‘ngorrkang’), and monosyllabic nominal roots (e.g. ‘man-kung’). In each case there is only one potentially accentable syllable, the final syllable being generally unaccentable. The general unaccentability of the final syllable means that in a word such as ga-bert-rung, (3sg-tail-burn, ‘His tail burns’), the rightmost accentable morpheme is bert. Finally, phrases ending in a high boundary tone (H%) were omitted from the analysis, since in such phrases, usually only the initial accentual rise on the first word in the phrase is evident (see Chapter 2, §2.3.5).

The frequency counts given for the Kuninjku texts in Tables 3.1 and 3.2 are for the whole of the texts, excluding a few tokens left unlabelled for intonation in the corpus. In contrast, the figures given in Tables 3.3 and 3.4 for the Manyallaluk Mayali texts (speaker PB) do not represent true frequency counts, since it was not possible to determine the position of accent with certainty for a number of the words in these texts. The pitch range in the texts by this speaker is generally very compressed. This means that in many words, F0 movements associated with accent are not easily discernable from those due to segmental perturbations and differences in the intrinsic F0 of vowels. Nonetheless, there are sufficient clear tokens to draw tentative conclusions regarding the default location of a single accent in nominal and verbal phonological words in Manyallaluk Mayali.

### 3.11.3 Results

Comparing the first two columns of Table 3.1 (frequency of accent placement in Kuninjku verbs), the number of single accents which fall on the leftmost foot in a polymorphemic word is almost six times the number which fall on the rightmost foot. (‘Rightmost’ refers to the rightmost accentable foot; the final monosyllabic morpheme is ignored.) In nominal words (Table 3.2), the bias is even more pronounced: in fifty words which bear a single accent, the accent never falls on the rightmost foot. Thus, although the rejection of a single accent from the rightmost foot is not absolute across both word...

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30 See the Appendix for further examples of accent placement.
classes, there is a very strong trend overall in favour of accenting the leftmost foot. This may be attributed to the presence of an intonational End Rule Left, which constrains but does not rigidly determine the pattern of accentuation in the phonological word:

**End Rule (Left) (Kuninjku)**  
Place a default single accent on the leftmost metrically strong syllable in the phonological word.

In two of the Kuninjku nominal words, the single accent falls on a medial syllable (nabininj-kobeng, ngal-dah-daluk). It is not clear what the conditions are which favoured medial accent in these words. The small set of verbal words with a single medial accent are due to the tendency to accent a closed syllable (usually an incorporated noun or adverbial morpheme) following a monosyllabic or disyllabic prefix containing all light syllables (e.g. nga-radjdje, yi-libme, bi-barnnameng). This is evident in the columns for ‘rightmost and medial’ and ‘rightmost only’ accents as well as the ‘medial only’ column.

This tendency might suggest that the semantic salience of these lexical (stem) morphemes relative to the pronominal prefixes has an effect on accent assignment, but only when the alternative accentable material (the prefix) is relatively phonetically ‘weak’, and only when there is a single accent to be placed. There is one example, bene-djal-kang, in which accent appears to fall only on the initial syllable despite the following closed syllable (adverbial morpheme djal) but the example is not absolutely clear; a case could be made for there being an additional downstepped !H* accent on -djal- (Figure 3.40).

<table>
<thead>
<tr>
<th>Position of accent</th>
<th>Left-most foot only</th>
<th>Right-most foot only</th>
<th>Both left- and right-most feet</th>
<th>Left-most and medial feet</th>
<th>Right-most and medial feet</th>
<th>Medial foot only</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUCKOO</td>
<td>31</td>
<td>10</td>
<td>45</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>BILLABONG</td>
<td>35</td>
<td>2</td>
<td>59</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>NAMALADJ</td>
<td>15</td>
<td>1</td>
<td>36</td>
<td>2</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>TOTALS</td>
<td>81</td>
<td>13</td>
<td>140</td>
<td>6</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>% of accents</td>
<td>32%</td>
<td>5%</td>
<td>56%</td>
<td>2%</td>
<td>3%</td>
<td>2%</td>
</tr>
</tbody>
</table>

Table 3.1: Accent position in verbal phonological words in Kuninjku
Table 3.2: Accent position in nominal phonological words in Kuninjku

<table>
<thead>
<tr>
<th>Position of accent</th>
<th>Left-most foot only</th>
<th>Right-most foot only</th>
<th>Both left- and right-most feet</th>
<th>Left-most and medial feet</th>
<th>Right-most and medial feet</th>
<th>Medial foot only</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUCKOO</td>
<td>19</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>BILLABONG</td>
<td>21</td>
<td>0</td>
<td>16</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>NAMALADJ</td>
<td>8</td>
<td>0</td>
<td>11</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>TOTALS</td>
<td>48</td>
<td>0</td>
<td>38</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>% of accents</td>
<td>56</td>
<td>0</td>
<td>39</td>
<td>2.5</td>
<td>0</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Table 3.3: Accent position in verbal phonological words in Manyallaluk Mayali

<table>
<thead>
<tr>
<th>Position of accent</th>
<th>Left-most foot only</th>
<th>Right-most foot only</th>
<th>Both left- and right-most feet</th>
<th>Left-most and medial feet</th>
<th>Right-most and medial feet</th>
<th>Medial foot only</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBTXT1 - 4</td>
<td>6</td>
<td>33</td>
<td>12</td>
<td>0</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>% of accents</td>
<td>11</td>
<td>58</td>
<td>21</td>
<td>0</td>
<td>11</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 3.4: Accent position in nominal phonological words in Manyallaluk Mayali

Figure 3.40: Token of bene-djal-kang with accent on be-. Gloss: 3ua/3-just-carryPP. Translation: ‘The two of them just carried it.’

Sound file 3.60: IP-unique token of bene-djal-kang
Insofar as there is a preference for not accenting a light initial prefix, it is one that is readily overridden when there is more than one accent to be placed. In this case, there is a very strong tendency to accent the initial and the final accentable feet in the word. These feet usually correspond to a noun class prefix or pronominal prefix, and the root.

The data from Manyallaluk Mayali presented in Tables 3.3 and 3.4 is more sparse. Nonetheless, a quite different pattern of default accentuation emerges. There is evidently a much stronger constraint in MM against the accentuation of noun class and verbal pronominal prefixes, or in favour of accenting the root. In this, it appears similar to Ngalakgan, which rejects accent on prefixes.\(^{31}\) However, the rejection in Manyallaluk Mayali is conditional, not categorical. In verbal words in MM (Table 3.3), the only clear examples of a single accent being placed on the pronominal prefix instead of the root are in tokens where the initial syllable of the root is light. There is a tendency not to accent the root when this is the case (see section 3.6). In all other tokens with a single accent, the accent falls on the verb root, or, where the verb root is monosyllabic, on the immediately preceding morpheme. There are just two examples of the latter: in yi-ban-won, the accented morpheme -ban- is the third person plural object pronominal prefix; in ba-djal-yoy, the adverbial prefix -djal-, meaning ‘just’. The default location of a single accent in verbal words in MM is evidently the opposite to that found for Kuninjku: it is the rightmost accentable foot. However, when a second accent is to placed, the same pattern emerges as for Kuninjku: accents on the initial and the final accentable feet in the word. Thus, in a word such as gandi-gerre-worrhmen (1a.inclusive-ground.oven-light.fireIMPER, ‘let’s light a/the ground oven’), accent falls on the initial and final morphemes; the prefix does not ‘reject’ accent where there is more than one accent to be assigned to the word.

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\(^{31}\) Baker (1999) analyses the conditioning factor for accent in Ngalakgan as, at least partly, ‘semantic weight’: a privileging of content morphemes such as roots over functional morphemes.
Turning to Table 3.4, nominal words in MM, the pattern is generally the same: where there is a single accent to place, the root is accented in preference to a noun class prefix. However, the root is also accented in preference to an accentable suffix to the right of the root: *dat-kudji* (‘leg-one’), *dat-burrgen* (‘leg-two’), *dabu-gen-no-yi* (‘egg-GEN-POSS-ERG’). This suggests that the appropriate rule of default accentuation in MM is not a purely positional rule, such as: ‘if a single accent, accent the rightmost foot’. Rather, it appears to be a rule that is sensitive to the lexical status of the morpheme: ‘if a single accent, accent the foot corresponding to the root morpheme’. Such a rule will generally result, indirectly, in the accentuation of the rightmost foot in the phonological word. On the other hand, in a word such as *dabu-gen-no-yi*, with three suffixes following the root, the accent will be quite far from the right edge of the word.

Where there are two accents to place in an MM nominal word, the second accent in a nominal word will nonetheless fall on the suffix, if there is one, in preference to any prefix. Thus, in the utterance *gun-marlaworr-dorrreng* (IV-leaf-with, ‘with a leaf’), the

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32 Manyallaluk Mayali has more productive suffixal morphology than Kuninjku, with the 3rd person possessive suffix -*no* being extended to use as more general ‘part class’ suffix (for example, the citation form of the word ‘leaf’ in MM may be given either as *gun-marlaworr*, with the noun class prefix *gun*, or *marlaworr-no*, where the use of *no* marks the leaf as part of, or belonging to, a larger entity, the tree. The most productive nominal morphology in MM is suffixal, whereas the verbal morphology is predominantly prefixal.
suffix -dorreng, ‘with’ is accented but not the neuter noun class prefix gun-. Another example is marlaworr-no-yi, leaf-POSS-ERG, ‘using a leaf’. The noun class prefix can, however, bear a second accent in the absence of an accetable suffix, as in na-gimuk-gen (MA-big-GEN, ‘big one(s)’), na-gimuk.

3.11.4 Discussion and summary

In Kuninjku, a single accent will be located, by default, on the leftmost foot in the phonological word. Similarly, all being equal, a second accent, if there is one, will be located on the rightmost foot in the word. The principal factor conditioning the location of pitch accents in Kuninjku is therefore the relationship between accent, metrical structure and the edges of the phonological word constituent.

Such a relationship between prosodic prominence, metrical structure, and word edges is not uncommon cross-linguistically. Selkirk (1995: 565) observes,

Note that it is a recurrent fact about patterns of word stress that the syllables heading feet at both the right and left periphery of a word are more prominent than those in non-peripheral feet.

In Manyallaluk Mayali, there are two distinct factors conditioning accent placement. The first is the default association of a single accent to the foot in the phonological word which corresponds to the root morpheme. This would seem to indicate a relationship between the lexical status of the morpheme and its accentability. The foot corresponding to the root morpheme is also frequently, but not always, the rightmost acceptable foot in the word.

In contrast, the location of a second accent appears to respond to a purely edge-marking function, as it does in Kuninjku. In Manyallaluk Mayali, the second accent is located on the leftmost foot of the word domain.

In English intonation, the final accent in an intermediate or intonational phrase is said to be the ‘nuclear’ accent. It is possible to phonologically differentiate this accent from preceding accents in the phrase on the basis of its effects on focus structures. In relation to Bininj Gun-wok, we have, at present, insufficient data for which the focus structure is unambiguous to determine if there is any relationship between accent assignment in the word and focus. Narrative data generally does not provide the
necessary evidence (from informational context) to analyse closely any correlations between the accent structures described and focus structures (but see section 3.12). In this respect, narrative data resembles citation form data that is uncontrolled for discourse (or information structure) context: it frequently lacks independent evidence for the speaker’s intended focus structure.

There are two primary aspects to the determination of relationships between accent, prosodic structure and information structure. One is knowing the information structure context of the utterances analysed. The other is knowing the set of possible associations between accent and prosodic structure in the language in question. It is the latter which this section has sought to elucidate: what the possibilities are for accent assignment within the word in Kuninjku, how many accents can be placed on a word, and the default location of a single accent. In the following section, I will briefly discuss and illustrate, in a qualitative fashion, aspects of the relationship between the relative perceptual prominence of accents, prosodic structure and information structure in Kuninjku. In the previous sections, the focus was on the distribution of accents; in the following section I will discuss qualitative aspects of their scaling, in relation to the perception of relative prominence.

3.12 Relative accent prominence, prosodic structure and aspects of information structure in Kuninjku

3.12.1 Literature on the perception of relative prominence between accents

There is quite a substantial literature on relative prominence relations between accents, and their phonological status and representation, much of it in the autosegmental-metrical model of intonation (Gussenhoven and Rietveld, 1998; Rump and Collier, 1996; Ladd, 1996, 1993a, b, c, d; 1990b, 1983a; Ladd, Verhoeven and Jacobs, 1994; van den Berg, Gussenhoven, and Rietveld, 1992; Pierrehumbert and Beckman, 1988: Chs. 3 and 4; Liberman and Pierrehumbert, 1984; Pierrehumbert, 1980).

One of the issues discussed in the literature is the relationship between accent height and the perception of accent prominence in two-accent phrases (Ladd, Verhoeven and Jacobs, 1994; Gussenhoven and Rietveld, 1998; Liberman and Pierrehumbert, 1984). As with the perception of pause duration (see Chapter 2, §2.6.2), there is no
straightforward correlation between the (psycho)acoustic height of a high pitch accent (in F0 or semitones) and its perceived prominence. Rather, there appear to be strong effects of context: the height of both pitch accents feeds into the perception of the prominence of each one (Ladd, Verhoeven and Jacobs, 1994; Gussenhoven and Rietveld, 1998).

Rietveld and Gussenhoven (1985) carried out an experiment, replicated and extended in Ladd, Verhoeven and Jacobs (1994), in which listeners rated the prominence of the second of two adjacent peaks of varied height on a 10-point scale. The majority of listeners in Rietveld and Gussenhoven’s experiment were able to discern differences in the prominence of peaks when the magnitude of the F0 excursion differed by at least 1.5 semitones. Within the typical mid-range for accent peaks produced by the male speaker in this study – approx. 150 to 260 Hz – a difference of 1.5 semitones corresponds to a difference of 14 – 21 Hz. This gives an extremely rough guide as to the minimum magnitude of differences in F0 one might expect to find correlated with a difference in relative prominence (downstep or upstep) between accent peaks. However, this simple figure does not take into account one of the most widely attested factors in the perception of the prominence of adjacent accents: the “declination” effect.

In their experiment, Ladd, Verhoeven and Jacobs (1994) incorporated a slightly tilting ‘baseline’ into the two-accent phrase stimulus. For the purposes of the experiment, the baseline was measured as the low onset and offset F0 values before and after accent rises and falls. These values constitute what Ladd (1993) refers to as the ‘overt baseline’. In the experiment, the low onset point of the contour was set at 116 Hz, the valley between the peaks at 106 Hz, and the low offset point at 90 Hz.

Although such an overtly declining baseline is readily observable in declarative utterances in a great many languages, Ladd (1993) argues that a more subtle and complex concept may be required in order to relate observed downtrends in accent peak heights within a phrase to the perceived prominence of the peaks. Ladd proposes that “what declines in declination is not necessarily F0 itself, but rather an abstract backdrop against which F0 is interpreted linguistically” (1993: 436). He refers to this as the “implicit decline” view (1993: 436). Effectively, in this view, the height of individual accent peaks and troughs is an epiphenomenon of a combination of local pitch range and local prominence relations between accents within the phrase. The declination of accent peaks
and troughs within the phrase is mediated by a ‘reference line’, a mathematical construct calculated partly on the basis of local pitch range.

The implicit decline view takes account of the observation in Pierrehumbert (1980) and Liberman and Pierrehumbert (1984) that two peaks in a phrase may be perceived as having equal prominence when the second peak is slightly lower than the first, while if the second peak is of similar height, it will tend to be perceived as the more prominent of the two. This indicates that the height of peaks is assessed against a backdrop of an expected decline in F0 throughout the phrase, an expectation which is captured by the notion of the reference line.

I have made use of this assumption of implicit decline in my labelling of upstep and downstep relations between accents in Kuninjku, as described in section 3.12.3 below.

3.12.2 Literature on the relationship between prosodic structure, downstep and upstep (emphatic accent)

In English, the relationship between the presence or absence of accent on a word, pitch prominence, and focus (broad, contrastive or information\(^{33}\)) is strongly constrained by prosodic structure. The prosodic structure constraints dictate, for example, that a broad-focused syntactic constituent must, in general, bear at least one accent on the final accentable word. In most constructions, deaccentuation of the final accentable word or words correlates with a percept of narrow focus on a preceding accented word. Ladd (1996:76) gives the example of the phrase ‘my uncle’s notebooks’. Accenting ‘uncle’s’ and deaccenting ‘notebooks’ produces narrow focus on ‘uncle’s’, while accents on both ‘uncle’s’ and ‘notebooks’ – whether the second accent is downstepped or not – produces a broad focus reading.

Pierrehumbert (1980: 186) cited utterances such as the latter as evidence for a purely tonal downstep rule, that is, a rule affecting the phonetic scaling of accents, but not necessarily affecting the prominence structure of utterances. Pierrehumbert argues that in an example such as ‘uncle’s notebooks’ with a downstepped final accent, the word with

\(^{33}\) As mentioned in Chapter 1, I use the term ‘information focus’ to describe information which may have been previously mentioned, but is re-mentioned and emphasised in the present utterance.
the downstepped accent has “greater prominence” (1980: 186) in the phrase, despite its reduced pitch prominence.  

In effect, there is a bifurcation between types of focus in English and their correlation with pitch prominence. An interpretation of broad focus correlates (1) with the presence of accent in a particular position in the prosodic structure of an intonation phrase, and (2) with the absence of any (generally, emphatically raised or upstepped) accent followed by deaccenting within the phrase. The presence of such an emphatically raised accent, on a word in any position in the phrase, in conjunction with deaccenting of following words, is correlated with an interpretation of contrastive or information focus.

Furthermore, a common realisation of an utterance with broad focus in English is a downstepping contour. In such a contour, with broad focus interpretation and normal pitch range, it appears that the relative pitch prominence of the accents is not assessed in terms of the relative informational salience of each word (Ladd et al., 1994: 87); rather, the phrase as a whole constitutes an informational unit. This analysis suggests a differential interpretation of downstep in contrastive or information focus contours, on the one hand, and broad focus contours, on the other. In contrastive or information focus contours, the pitch prominence of each downstepped accent would be individually assessed as relating to the informational salience of the word to which it associated, relative to other words within the phrase; in broad focus contours, it would not be so assessed.

In the following section, I will examine the expression of information focus in Kuninjku with respect to the relationship between the prosodic structure and the relative pitch prominence of accents.

3.12.3 Relative pitch prominence and information focus in Kuninjku

Downstepping contours are quite frequent in Kuninjku, and may even constitute the default broad focus contour. Further research using data controlled for information structure is needed on this question; the observations in this section are merely intended as preliminary.

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34 The notion of ‘prominence’ Pierrehumbert refers to is a somewhat obscure, phonological notion. Perceptually, the prominence of the downstepped accent is partly due to its preceding a phrase-final fall; the F0 falls lends the syllable
As observed in Fletcher and Evans (1998), with regard to data from the Gun-Djeihmi and Kundednjenghmi dialects, there appears to be no constraint on accenting repeated information in BGW, nor is there any clear evidence of deaccenting following narrow focus on a word. Repeated lexical items are quite frequently emphatically accented.

One consequence of the lack of deaccenting is that a contour with contrastive or information focus on an initial word in a phrase is not clearly phonetically distinct from a downstepping, broad focus contour, since in both cases, downstepped accents follow the initial word. It is possible that there is a paradigmatic difference in the height of the initial accent when the initial accented word carries contrastive or information focus, compared with the height of the accent in a broad focus context (see Figure 3.45).

However, if the focused word is non-initial in the phrase, the peaks of preceding accents tend to be increasingly higher, up to the accent on the focused word (see Figures 3.42, 3.44).

In the data used in this dissertation, I have only labelled downstep and upstep where there is a clear percept of reduced or increased pitch prominence relative to an adjacent accent peak. F0 differences between peaks were not used alone in deciding whether or not to label a peak as downstepped or upstepped. I assume that the context – the height of other peaks in the phrase and an expectation of decline – may affect the perceived prominence over and above the acoustic measure of F0 differences. This assumption appears warranted by the Kuninjku data.

For example, the expectation of decline accounts for instances in which the final accent in a level or slightly rising sequence of accents sounds most pitch prominent, despite there being only a very small difference in actual F0 values between the accents. Figure 3.42 illustrates a contour in which this is the case. In this contour, the word man-berrk, ‘open, dry country’ impressionistically carries the strongest prominence of the utterance, despite a difference of only 6Hz in peak height relative to the preceding peak35. Importantly, the trend across the first three accent peaks is a slight rise in F0, contrary to

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35 The clear downstep on the following peak may also contribute to the percept of prominence in this accent.
the expectation of decline. This would seem the most relevant factor in my perception of *man-berrk* as carrying the strongest prominence in the utterance.

![Figure 3.42](image-url)  
**Figure 3.42:** Rising sequence of accents in a Kuninjku utterance, with the strongest prominence in the utterance falling on *man-berrk*.

Transcription: [nakka-mak] kalawan nungan man-berrk ka-h-re  
Gloss: [MA:IMM.PREV.-other] goanna.sp. he open.dry.country 3-IMM-goNP  
Translation: ‘[That other one we were just talking about,] kalawan, he just walks about in the open dry country.’

**Sound file 3.62**

The context of the utterance also supports the analysis of *man-berrk* as bearing the strongest prominence. The context is a discussion between the linguist Murray Garde, who recorded the text, and the Kuninjku speaker MK2. Garde is eliciting Kun-Kurrng (mother-in-law register) equivalents for ordinary language terms using pictures: the subject of the present discourse segment is the names of goanna and other reptile species. The speaker’s utterance in full is *nakka-mak kalawan nungan man-berrk ka-h-re*, which translates as ‘that other one we were just talking about, kalawan, he just walks about in the open dry country’. The words *nakka mak*, ‘that one also’, tells the hearer that this is a previously mentioned referent which he will need to reactivate in his memory, while the rest of the topic, *kalawan nungan*, clarifies the intended referent. The informative element in this phrase – the truly new information – is thus the phrase *man-berrk ka-h-re*.  

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203
There is a correspondence, then, between the strong prosodic prominence of the word *man-berrk* within this phrase and its role in the information structure of the utterance. Within this phrase, it is the element which bears the information focus, *man-berrk*, which is most strongly accented, while *ka-h-re*, which is relatively information-poor, carries a downstepped accent. Together, the sequence of a strong and a weaker accent contributes to the prosodic (and indeed, the grammatical) coherence of the phrase *man-berrk ka-h-re*.

Figure 3.43 illustrates information focus associated with primary phrasal prominence on *ku-ngorl*, ‘in the clouds’. The utterance describes a creature ‘looking around the place’ for food (*bolk-nang wam*). This action of looking around is established information at this point in the narrative: it follows some time after the utterances illustrated in Figures 3.44 to 3.46. The word *kaddum*, ‘high above’, introduces some new information, but in an underspecified way. Further specification is added by *ku-ngorl*, which emphasises just how ‘high up’ the creature is looking. The latter word is both the crux of the information content of the intonation phrase in which it occurs, and bears the strongest prosodic prominence.
Figure 3.43: Rising sequence of accents in a Kuninjku utterance, with the strongest prominence in the utterance falling on ku-ngorl.

Transcription: kaddum kure ku-ngorl bolk-nang wam
Gloss: up.above LOC LOC-cloud 3P-place-lookPP 3P-goPP
Translation: ‘High up, there, he went looking around the place, in the clouds.’

Sound file 3.63

The following three utterances (Figures 3.44 to 3.46), which differ minimally in lexical content, illustrate one speaker’s manipulation of accent prominence and information focus within a single narrative. In this narrative, two men are hiding away from a creature who is looking around for food, and would kill them if it came upon them. Figures 3.44 to 3.46 correspond to the utterances presented in bold in the narrative segment given on the next page. In each of these utterances, a different element of the situation is being highlighted.

In the first utterance given in bold type (illustrated in Figure 3.44), the culminative prominence of the utterance falls on bene-yoy: the accent on bene-yoy culminates a gently rising sequence of accents and is perceptually the most prominent accent. The fact that the two men are lying down in order to be hidden is emphasised.

In the second utterance in bold type (see Figure 3.45), the strongest prominence falls on the adverb konda, ‘here’, while kanjdji and bene-yoy carry downstepped accents. In the third bolded utterance, the repeated word kanjdji, ‘underneath’, carries the strongest prominence, conveying emphasis on the men’s position underneath the spot where the creature is looking around. Thus, in each of these (non-broad focus) utterances,
relative prominence relations between accents are manipulated in order to highlight particular elements of the context.

**Figure 3.44:** Relative prominence relations in the utterance *but name kanjdji bene-yoy* (‘but they had lain down, underneath,’) with primary phrasal prominence on *bene-yoy*, ‘they had lain down’.

*Sound file 3.64*

**Figure 3.45:** Relative prominence relations in the utterance *konda kanjdji bene-yoy* (‘(just) here, underneath, the two of them lay down’) with primary phrasal prominence on *konda*, ‘here’.

*Sound file 3.65*
Figure 3.46: Relative prominence relations in the utterance *but nani kanjdji bene-yoy* (‘but those two, they had lain down underneath …’) with culminative prominence on *kanjdji*, ‘underneath’.

*Sound file 3.66*
3.13 Conclusion

In this chapter I have discussed the conditions for postlexical pitch accent assignment and distribution in the Kuninjku and Manyallaluk Mayali dialects. Two questions are important in the classification of postlexical pitch accent type: what constitutes the potential for accent, and on what basis pitch accents are actually distributed in a given
word or phrase. Thus, in a stress accent system, metrically strong syllables are potentially accentable, while in a phrasal accent system, such as Korean, the accentable syllable or syllables are defined in relation to one or both edges of an accentual phrase constituent.

The data presented in this chapter demonstrate that the location of pitch accents in BGW words is basically conditioned by metrical structure, which is calculated on the basis of morphological structure within the morphosyntactic word. Important evidence for metrical strength as the potential for accent in BGW comes from the fact that Kuninjku and Manyallaluk Mayali words can optionally bear more than one pitch accent, and that the location of the second accent is generally a metrical head as determined by the metrical structure algorithm. Neither the default accent nor a second accent necessarily associates with either a specific morpheme or a specific position in the word (e.g. the penultimate syllable). For these reasons, accent assignment in BGW cannot be assimilated to either a lexical or a morphological accent system – in which particular morphemes always carry accent – nor to a postlexical phrasal accent system, as diagnosed by a fixed location of accent in relation to the phrase edge.

However, accent distribution in BGW does appear to respond to a word-delimitative function. In Kuninjku, a default single accent typically associates with the head of the leftmost foot in a polypedal phonological word, and a second accent generally associates with the rightmost foot. In Manyallaluk Mayali, a default single accent associates with the root of the morphosyntactic word, however, again, a second accent seeks out a word-peripheral foot: the leftmost foot.

Basic accent-to-stress association aside, it does not appear that the principles underlying the placement of pitch accents in BGW are at all comparable to the placement of accents in a stress accent language such as English. Accent placement appears to be considerably less free (or ‘dynamic’) in BGW than in English; as Fletcher and Evans (in press) observe, there is “no compelling evidence that either [BGW or Dalabon] shifts pitch accents to produce pragmatic interpretations of an utterance, unlike certain other languages, e.g. English, Italian or German.” Accent in BGW cannot be freely associated with just any lexical morpheme in a polymorphemic phonological word (e.g. in order to focus or emphasise a morpheme), but generally, only associates to word-peripheral feet, or, in MM, to the foot corresponding to the root morpheme. This finding relates back to
the question posed in Chapter 1, section 1.2.2, about the relationship between prosody, information structure and the amount of semantic information carried by lexical morphemes on the verbal word in polysynthetic languages. In BGW, external nominals, adverbs and quantifiers are typically used when the content they express is to be highlighted or focused in the discourse, rather than incorporated or prefixed forms plus a form of prosodic highlighting. Incorporated nominals, on the other hand, tend to be used when the content they express is backgrounded or given in the discourse (Evans, in press: §10.4.2.6). Evans (in press: §10.4.1) observes in relation to external vs incorporated nominals that “all logically possible combinations – incorporated noun only, incorporated noun plus external noun, external noun only, and noun represented by a zero (i.e. neither incorporated noun or external noun) are grammatical” in BGW, and that “[t]he differences between them represent a number of constructional and discourse differences”. Interestingly, since incorporated nominals are found medially in the verbal word, they will frequently bear no accentual prominence, but only the F0 transition between word-peripheral accents (cf. the incorporated nominal yaw in Figure 3.11), or between an accent and a low boundary.

There is also no systematic use of deaccenting in BGW. Only a small class of verb-external words – generally, discourse markers, prepositions and demonstratives – can occur without accent in an intonational phrase ending in a low boundary tone. In phrases ending in H%, prominence relations between words are typically suppressed throughout the phrase, regardless of their lexical category (see Chapter 2, §2.3.5). To my knowledge, the only context in which a verbal word may appear without discernable accent is when it is non-initial in an H% phrase.

These observations raise the issue of whether there is any interaction at all between postlexical accent assignment and information structure in BGW. I believe that there is, but that the interaction resides largely in relative prominence relations created by accent scaling (i.e. local modifications of pitch range). In English, both the presence (location) and the scaling of accent play a role in relation to the interpretation of information structure. In section 3.12 I speculated, on the basis of Kuninjku data, that a relationship may hold between focus and relative prominence relations between accents in that dialect, such that broad and contrastive/information focus contours form two
distinct contexts for the interpretation of downstepped (lower scaled) high pitch accents, relative to non-downstepped. The presence of an upstepped accent may trigger a contrastive/information focus interpretation of a phrase, focussing the hearer’s attention on the relative scaling of each accent in the phrase, and its corresponding contribution to the informational content of the discourse, rather than the scaling of the phrase as a whole, as in a broad focus context.

Finally, word class is not a factor in the distribution of accent in BGW. In Kuninjku, the default accent is typically associated with the leftmost foot in words from both major word classes, nominals and verbs. In words from both classes, a second accent will generally be placed on the rightmost foot. While there is a stronger tendency for verbal words to bear a second peripheral accent, this may relate to the fact that verbal words are often longer – have a larger number of feet – than nominal words. In those words in the data set which bear a medial accent, another constraint appears to have overridden the peripheral accent constraint: namely, that when a light word-initial syllable (CV) is followed by a heavy syllable (CVC or CVCC), the heavy syllable should preferentially bear the accent (as described in section 3.6).
Chapter 4

Acoustic correlates of metrical strength

4.1 Introduction and overview

As described in Chapter 3 (§3.2.2), metrically strong syllables in stress accent languages often exhibit a number of acoustic correlates of metrical strength. These correlates, which I will refer to as phonetic stress, are generally said to include duration and intensity, and in some languages, vowel quality. However, the acoustic correlates of metrical structure can vary considerably, both within a language (from utterance to utterance, and from speaker to speaker) and between languages (see Dogil and Williams, 1999 for a comparison of acoustic stress correlates in Lithuanian, Polish and German; also Hayes, 1995: 2).

In this chapter, I present statistical findings on paradigmatic correlates of metrically strong, accented syllables vs metrically weak, unaccented syllables in Kuninjku. I also briefly raise some issues relating to the inconsistency of syntagmatic cues to prominence in the Kuninjku data.

4.2 Acoustic correlates of metrical strength in stress accent languages

In order to distinguish clearly between phonetic stress and metrical strength, I use the latter term to denote an essentially abstract quality, determined by the position of a syllable in a systematically assigned metrical structure (assigned by algorithms such as those described in Hayes (1995), or Halle and Vergnaud (1987); also refer to Chapter 3, §3.3). This usage accords with the distinction drawn between ‘metrical strength’, ‘stress’ and ‘pitch accent’ in Ladd (1996: 56-59), in which it is motivated at greater length.

Fundamental frequency (F0) has often been included among the acoustic correlates of stress in the literature. However, more recent research argues for the separation of intonation (changes in F0) from certain acoustic correlates of metrical
strength ‘proper’, such as duration and intensity. Insofar as intonational accents are attracted to (associate with) metrically strong syllables, F0 is only an indirect acoustic correlate of metrical strength. In some languages, the F0 correlate is experimentally separable from the remaining direct correlates, for example, under conditions of pragmatically-conditioned deaccentuation in English (Beckman, 1996; Harrington et al., draft)). Under these conditions, increased duration and intensity remain, statistically, significantly greater in metrically strong, deaccented syllables than in metrically weak syllables. However, it is as yet unclear whether the increases are perceptible, and are used as cues to lexical stress by listeners (Harrington et al., draft)).

Duration is a particularly complex correlate of metrical strength (Nootboom, 1999; Turk and White, 1999; Beckman and Edwards, 1990; Lehiste, 1970). Since it is a “phonetic resource” (Hayes, 1995) used by both the segmental and the prosodic phonological components of languages, the allocation of this resource to particular functions within a language must be such as to avoid confounding other functions it might serve. For example, Hayes (1995:7) cites Berinstein’s (1979) finding that in languages with phonemic vowel length contrasts, duration tends not to be a correlate of stress (presumably, the languages Berinstein discusses are not quantity sensitive). Conversely, however, a language in which duration is not functionally committed to lexical distinctions will not necessarily use duration to cue prosodic prominence. In northern Bizkaian Basque, a language without distinctive segment length in either consonants or vowels, lexical accent is not accompanied by a durational cue. In this it resembles Tokyo Japanese, which does have a contrast between short and long vowels and consonants (Hualde, Smiljanic and Cole, 2000).

In languages in which duration is an acoustic correlate of metrical strength, the relationship of syllable duration to metrical strength may be reflected in the reduction (shortening) of unstressed syllables; or increased duration of stressed and unaccented syllables relative to unstressed; or additional, accent-induced lengthening. Such

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1 Though an acoustic correlate of phonetic stress, loudness in itself is not a strong perceptual cue to stress. Alone, it is a weaker cue than both pitch (F0) and duration in English; however, “if one integrates loudness over the duration of the syllable, this yields a measure that correlates with stress judgments [in English] slightly better than pitch alone” (Hayes, 1995: 6-7, citing Beckman and Pierrehumbert, 1986: 272)

2 Such constraining effects of the allocation of phonetic resources within a phonological system on their use in rendering a particular phonological contrast is of course not peculiar to stress: cf. Anderson (1981) for evidence of many other cases of such constraints in segmental and tonal phonologies.
lengthening may, in addition, differentially affect the component segments of the syllable, the onset, peak (vowel) and coda; the relevant literature is reviewed in section 5.4.4.2 of Chapter 5.

Evidence for metrical structure in stress accent languages may also come from differences in vowel quality. In English, for example, ‘reduction’ and ‘enhancement’ of distinctions in vowel quality appear to be correlates of metrical weakness and of intonational accent, respectively. Significant differences in vowel quality have been found to correlate with the presence of intonational accent, such that accent tends to increase the peripherality (or distinctiveness) of vowels within the vowel space relative to stressed but unaccented vowels (Harrington, Butcher and Palethorpe, 2000; de Jong, 1995). On the other hand, centralisation (a tendency toward schwa, or reduction of phonemic distinctions in vowel quality) tends to characterise vowels which are both metrically weak and unaccented (Fear, Cutler and Butterfield, 1995).

At a more abstract level, metrically strong syllables tend to be more resistant to elision or reduction than metrically weak syllables (Beckman, 1996; Fletcher and Evans, in press). In Kuninjku, there is some evidence for the metrical weakness of certain syllables from elision patterns in rapid connected speech; this will be illustrated in section 4.6.4.

4.3 Acoustic correlates of metrical strength in Australian stress accent languages

To date, only a handful of studies have examined the acoustic correlates of metrical strength in Australian languages: Fletcher and Evans (in press: Dalabon and Kundedjinjenghmi); Bishop (2002: Kuninjku); Pentland and Ingram (2001), Pentland (2000) and Harrington, Butcher and Palethorpe (2000): Warlpiri; King (1994: Dyirbal). Baker (1999) presents an interesting, but qualitative, discussion of unusual correlations between vowel quality and metrical strength in Ngalakgan (see §4.3.3 below).

4.3.1 Duration

King (1994) compared vowel and consonant durations in accented and unaccented syllables in connected speech from three speakers of Dyirbal. According to Dixon (1972), stress in Dyirbal is alternating, with ‘primary stress’ always located on the initial syllable
of the word. Primary stressed syllables are those with the potential to carry pitch accent, in King’s account. Since accented syllables in Dyirbal are always word-initial, variation in word-position is not relevant to measurements of the duration of accented syllables in Dyirbal, unlike in BGW (see §4.5.1). However, King did measure utterance-final unaccented vowels separately, so as to exclude vowels affected by phrase-final lengthening from the duration measurements of unaccented vowels.

King compared the durations of vowels in accented and unaccented, non-utterance-final syllables for each of three speakers (1994: 64-5), and found some evidence that on average, accented vowels were lengthened relative to unaccented. However, she also noted considerable variability as to whether or not accent-induced lengthening occurred in any given vowel. Moreover, the frequency with which lengthening occurred varied between speakers: two of the speakers “lengthened their syllables [sic.] with pitch accents in just under half of the cases”, while the remaining speaker did so “to a far greater degree” (1994: 64). King does not state whether unaccented but metrically strong vowels were included among the unaccented tokens, but it appears that the acoustic correlates of vowels which are stressed but unaccented – according to the traditional description of Dyirbal alternating stress patterns – were not examined.

In a recent study, Fletcher and Evans (in press) compared the durations of ‘prenuclear’ (non-phrase-final) accented syllables, ‘nuclear’ (phrase-final) accented syllables and unaccented syllables in Dalabon and the Kundedjnjenghmi dialect of BGW. In contrast to the findings of the present study (§4.6), they observe a significantly increased average duration of accented syllables (both prenuclear and nuclear) in relation to unaccented, in the Kundedjnjenghmi dialect. Prenuclear accented syllables (in which no effect of phrase-final lengthening on the word-final foot is present) are found to have an average duration of 168ms, compared to unaccented syllables, with mean duration of 114ms.

Pentland (2000) examined duration as a correlate of stress in citation forms elicited from two female Warlpiri speakers. In citation form, Warlpiri words bear an intonational accent on the initial syllable of words. Pentland found significant phrase-final lengthening in the final vowel of words with 2-, 3- and 4-syllables, but no evidence
of lengthening in the initial stressed and accented syllable of the words, relative to non-final, unstressed syllables. Following on from Pentland (2000), Pentland and Ingram (2001) hypothesise that a durational effect of accent in Warlpiri has the onset consonant of the post-accentual syllable as its domain, rather than the accented vowel itself. Using a corpus of quadrisyllabic words composed of all open syllables, they found significant lengthening of the post-accentual consonant, relative to the onset consonants of the penultimate and final syllables.

Contrary to Pentland (2000) and Pentland and Ingram (2001), Harrington, Butcher and Palethorpe (2000) found the initial accented syllable in Warlpiri to be significantly shorter than a medial, unstressed syllable. Although Pentland and Ingram (2001) observed no significant effects of Speaker on the durational measurements from the two speakers whose speech they analysed, it is possible that differences in the prosodic strategies of the speakers used in the Pentland and Ingram, and the Harrington studies are responsible for these distinct findings across the studies.

The duration of the post-accentual consonant was not examined in BGW. Impressionistically, however, this does not appear to be a particularly strong position, at least on the basis of data from the Kuninjku dialect. For example, when the initial syllable of a pronominal word such as *nungan* [nUNan] or a demonstrative such as *nawu* [nawU] is accented (and also when it is not), the postaccentual glide or velar nasal is often elided ([nUan], [naU]) (see also §4.6.4.2).

Harrington, Butcher and Palethorpe (2000) also found significant lengthening of final vowels in Warlpiri citation forms comprising trisyllabic words composed of CV syllables, and Fletcher and Evans (in press) observed significant final lengthening of intonation phrase-final syllables in Dalabon and the Kundedjnjenghmi dialect of BGW.

### 4.3.2 Intensity (RMS amplitude)

Fletcher and Evans (in press) and the present study provide the only instrumental data currently available on intensity as an acoustic correlate of metrical strength in Australian languages. Fletcher and Evans’ data from Dalabon and Kundedjnjenghmi shows a small, but significant effect of stress/ accent on RMS levels (measured in dB) in both languages, in the order of 2 dB for Dalabon and 4 dB for Kundedjnjenghmi. All five vowels in
Kundednjenghmi, which are the same as those found in the other BGW dialects, and the six vowels of Dalabon, which adds a central high unrounded vowel to those of BGW, were grouped together in ‘accented’ and ‘unaccented’ conditions to produce these results.

4.3.3 Vowel quality

Baker (1999:127-130) observes patterns in the distribution of centralised and peripheral allophones of the non-low vowels in Ngalakgan ([i] ~ [ɪ], [u] ~ [ʊ], [ɛ] ~ [ɛ], [o] ~ [ɔ]) such that stressed syllables, both open and closed, show the centralised allophones in all but word-final position. Word-final open syllables, whether stressed or unstressed, are realised with the peripheral allophone, and all unstressed syllables show the peripheral allophone. These findings might indicate a relationship between stress and sonority in Ngalakgan. Vowel sonority (a factor in syllable prominence) does not condition stress assignment in Ngalakgan (Baker explicitly rejects such a hypothesis: 207-208), but stress nonetheless appears to favour the centralised variants, which are likely to be the more sonorous allophones, by virtue of the increased jaw opening they entail.

Harrington, Butcher and Palethorpe (2000) also observe a relationship between word-finality and the distinctiveness of vowels in Warlpiri. The vowel spaces of the three Warlpiri vowels, which they denote /a/, /u/ and /i/, were found to be least confounded in word-final position, with considerable overlap of the vowel spaces observed in word-initial (accented) and word-medial positions. There is no evidence for vowel hyperarticulation as a correlate of accent, contrary to English. However, Harrington, Butcher and Palethorpe, like Pentland and Ingram (2001), hypothesise that the post-tonic consonant may be fortified (lengthened) by accent, assisting the preservation of all place and manner distinctions in this position.

Fletcher and Evans (in press) observed little evidence of regular processes of centralisation to schwa in Dalabon and the Kun-dednjenghmi dialect of BGW. There is, though, a tendency to delete unstressed vowels occurring in medial position in trisyllabic feet. Contrary to the findings of the present study in relation to the Kuninjku dialect, they also found a tendency toward slightly less peripheral vowels in unaccented syllables, though this tendency only reached statistical significance in the case of the low central vowel.
Butcher (1996) gives a brief and qualitative survey of vowel reduction processes in connected speech in a sample of languages from both central and northern Australia, including Burrara, Kunbarlang, Pitjantjatjara and Arrernte. Butcher cites Dixon’s (1980: 131) claim that vowels in Australian languages are seldom reduced in unstressed syllables, and argues, contra Dixon, on the basis of examples from a sample of languages, that processes of vowel centralisation (reduction to schwa) are quite common among Top End (north-central Australian) languages such as Burrara and Kunbarlang. Although Butcher’s examples clearly show that processes of vowel reduction do occur in some Australian languages, it is not clear to what extent systematic processes of reduction are involved – for example, whether such processes are attested in quite careful as well as rapid or casual speech.

4.3.4 Vowel elision
Vowel elision in rapid speech can provide important evidence for metrical structure. Metrically weak syllables tend to be elided in fast speech in the more prototypical stress accent languages, such as English and German, in contrast with languages such as French and Korean, in which accentual phrases constitute the rhythmic units, rather than stress feet. Beckman (1996) relates differences in rhythmic organisation in these two broad language types to differences in segmental reduction processes. Cutler and Otake (1996:5) summarise Beckman’s argument in the following manner:

[T]he level which matters in English and in German (both stress-timed languages) is the stress unit, or foot; deletion processes as observed in *support* and *beraten* do not affect stressed syllables, hence they leave the stress rhythm intact – the number of stress units does not change when a weak syllable is deleted.

In contrast, in languages such as French and Korean, “the effect of such processes may depend on a given syllable’s position in larger rhythmic groupings.” (Beckman, 1996:5) In BGW, the peaks of syllables which are metrically strong are generally preserved in rapid speech, and such syllables are occasionally phonetically ‘reinforced’ by gaining a coda from the elision of the following metrically weak vowel. In Figure 4.8, for example, elision of the second vowel in the pronominal prefix *birri* [bɪɾi] leaves the initially
metrically strong syllable as [bɪ] instead of [bɪ]. Fletcher and Evans (in press) similarly observe that “certain syllables (which are generally analyzed as being lexically stressed), resist syllable contraction, and are not generally elided in connected speech” in the Kundedjnjenghmi dialect.

Butcher (1996) states that in some northern-central (Top End) languages, such as Burarra and Kunbarlang, “elision of unstressed vowels [is] just as common as in English and other Germanic languages” (Butcher, 1996:5). However, this is not the case in Kuninjku, which does not show any systematic processes of elision affecting metrically weak syllables, though, as illustrated in section 4.6.4.1, such elision does sometimes occur in casual and rapid speech.

Butcher (1996) also cites an example from the Kunwinjku dialect (ku-bolk-buyiga, LOC-place-another, ‘another place’) in which a metrically strong syllable appears to be elided in connected speech:

\[ [\text{gubolk} \ '\text{bujiga}] \rightarrow [\text{gubolk} \ '\text{b1:q}] \]

However, another analysis of this example could be that the palatal glide has assimilated the high back (lax) vowel, with the sequence [ij] producing the perception of a single, long, high (lax) front vowel, rather than the metrically strong vowel having been elided altogether.

4.4 Aims of the study

In this study I examine whether the paradigmatic correlates of stress accent other than F0 described in the literature on stress accent languages, are also evident in Kuninjku. Specifically, this study seeks to determine whether an increased duration of accented syllables, increased mean peak RMS amplitude, and more peripheral vowel quality, are correlated with accented, vs unaccented, syllables in Kuninjku. Any effects of foot-level metrical strength (i.e. phonetic stress) are necessarily also a correlate of accented syllables, since accent associates with metrically strong syllables.
4.5 Method and corpus

Data for all statistical tests reported in this chapter were drawn from the Kuninjku dialect (specifically, the three narratives BILLABONG, CUCKOO and NAMALADJ).

4.5.1 Duration

In examining segment durations as a correlate of accent, I have sought to control for any durational effects on syllables deriving from their position in the word and in the intonational phrase or utterance (cf. de Jong and Zawaydeh (1999); Nakatani, O’Connor and Aston (1981), and Beckman and Edwards, 1990). The scope of this dissertation did not allow an examination of the acoustic correlates of metrical strength in speech controlled for conditioning factors such as segmental make-up, relative prominence patterns, speech rate, and the like. However, I hope to show in the following sections that it is possible to carefully discriminate between prosodic conditions, and thus to draw tentative conclusions regarding the manipulation of segment duration as a correlate of accent even in spontaneous speech.

For example, in monopedal words, syllables belong to both the word-initial and the word-final foot, while in polypedal words, word-initial feet, and the syllables in them, are at a distance of one or more feet from the end of the word. Word-final syllable lengthening effects, if there are any, might affect the first category of syllables but not the second, introducing a source of variability into the duration data.

To control for possible effects of word size on syllable durations, two categories of feet were differentiated in the data. Accented, word-initial syllables and unaccented second syllables, in pre-word-final bi- and trisyllabic feet, were labelled distinctly from accented and unaccented syllables in word-final bi- and trisyllabic feet.

Impressionistically, the initial syllables of long, polypedal words appeared to be shorter than the initial syllables of monopedal or short bipedal words. If this was found to be so, quantitatively, it might suggest that in some sense, the phonological word\(^3\) is acting as a higher-level timing unit (i.e. the domain of certain, perhaps positionally constrained, effects of compensatory polysyllabic shortening: cf. Turk and Sawusch (1997), Turk and

\(^3\) Or the phonological phrase: the two are generally coincident in Kuninjku (see Chapters 6 and 7).
In order to examine the question more closely, a comparable set of accented tokens were extracted from the data sets. The first set of tokens (n=48) comprised the heads of polysyllabic, word-initial feet (indicated by square brackets [ … ]_F), followed minimally by a bisyllabic foot within the word, and frequently, by more than one foot. That is, these tokens had the structure shown in (1) (where round brackets indicate optional elements, and the syllable duration measured is underlined),

\[
(1) \quad [\sigma \sigma (\sigma)]_F [\sigma \sigma (\sigma)]_F ([\sigma (\sigma) (\sigma)]_F)
\]

All the tokens chosen are prefixes to verbs and open (CV) syllables (/bI/, /ηα/, /ηυ/ or /jυ/). The second set of tokens (n=31) comprised the antepenultimate heads of word-initial polysyllabic feet, which were also the final foot in the word, or a bisyllabic foot followed by a monosyllabic foot:

\[
(2) \quad [\sigma \sigma \sigma (\sigma)]_F \text{ or } [\sigma \sigma]_F [\sigma]_F
\]

Again, all tokens chosen were prefixes to verbs, and open (CV) syllables of the same kinds as in the first set of tokens.

The final feet of words were also separately examined for word-final and phrase-final lengthening effects, which have been observed in other stress accent languages, including English (Beckman and Edwards (1990); Nakatani, O’Connor and Aston (1981)) and Jordanian Arabic (de Jong and Zawaydeh, 1999). Syllables from intonation phrase (IP)-final feet and utterance-final feet were initially labelled separately, but were conflated in the data used in the statistical analyses, in order to have sufficient tokens to contrast phrase-finality and phrase-non-finality. Thirty tokens was the minimum number on which statistical analyses were carried out in all cases.

Syllables in all positions in the word were also labelled according to foot structure. Syllables occurring in (surface) monosyllabic vs polysyllabic feet, as determined by the metrical structure algorithms given above, were labelled distinctly. A syllable may be longer when it alone constitutes a foot-level unit (Nakatani, O’Connor and Aston (1981) for American English; Turk and White (1999: 183), for Scottish
English). If such feet were not distinguished, they could introduce a bias into the data, since monosyllabic feet occur more frequently in some word positions (especially antepenultimate and word-initial) than in others. In the final analysis, monosyllabic feet were simply omitted from the data, as there were insufficient tokens to allow a comparison of syllable durations in monosyllabic and polysyllabic feet, respectively, by word position.

The duration of syllables was determined from wideband spectrograms in conjunction with auditory information. To supplement the visual evidence of the spectrograms, a process of listening to isolated segments was used, in order to detect whether any formant material belonging to the preceding or following segment had been included in the segmentation. This was done mostly in cases where the formant structure left what was judged to be too great a margin of uncertainty in the determination of segment edges. The spectrograms were calculated by the xspectrum program in Waves+, which has as its default parameters the use of a Hanning window of length 40ms and step size 2 ms. Word-medially, the offset of a final voiceless coda consonant was taken to be the onset of voicing of the following segment. Word-finally, the endpoint of a syllable with a voiceless coda consonant was labelled at the offset of voicing in the syllable; final voiced and voiceless consonants are invariably unreleased in Kuninjku. Figure 4.1 shows a typical segmentation. Periods of voicelessness between a voiceless coda and a voiceless onset were evenly divided between the respective syllables, as were geminate nasal consonants with the same place of articulation.
I syllabify long stops (written /bb/, /dd/, /djdj/ and /kk/ in Kuninjku), which phonetically tend to be voiceless throughout, as a single onset consonant, in contrast with geminate segments, which are syllabified as an onset and a coda, but are orthographically identical to long stops. In Figure 4.1, I analyse the sequence /djdj/ as a separate coda and onset on the basis that the second palatal stop is derived by assimilation of a velar stop /k/ to the preceding palatal stop.

4.5.2 Peak RMS amplitude

The points of measurement for RMS amplitude were hand-labelled and hand-measured at the RMS peak (which frequently coincides with the F0 peak), or, if no peak was discernible in the RMS trace, at a steady level in the vicinity of the mid-point of the vowel. Hand-labelling was found to be necessary, since automatic extraction (using the mu+ ‘track’ routine) based on the mid-point of the vowel produced a high proportion of spurious results.
An ANOVA was carried out on a subset of four of the five phonemic Kuninjku vowels to determine whether there are paradigmatic differences in mean peak RMS amplitude level between accented and unaccented vowels. There were insufficient unaccented tokens of the back mid-open vowel /a/ in the labelled data set to allow a statistical comparison of accented and unaccented tokens of that vowel. The vowels analysed are therefore the central open vowel /a/; /e/, which ranges from a mid-close to a mid-open front vowel; /i/, a lax, close front vowel; and /u/, a lax, close back vowel. There are no alternations which would suggest that [i] and [u] are reduced allophones of underlyingly tense phonemes /i/ and /u/; rather, these lax vowels appear to be the underlying forms. Indeed, /i/ occasionally sounds more peripheral when it occurs in the final unaccented syllable of a bisyllabic foot and between two accented syllables, than in the accented syllable of the same foot (see Figure 4.14).

4.5.3 Vowel quality
Vowels were labelled by hand in the Waves+ Transcriber interface, on a separate vowel tier, with the aid of spectrograms. Vowels were labelled for identity and accent status, e.g. ‘aa’ for ‘accented low central vowel /a/’, ‘ua’ for ‘unaccented low central vowel /a/’. Vowels followed by a retroflex segment or the semi-vowels [j] and [w] in the onset of the following syllable were omitted. Both the semi-vowels and retroflex segments tend to strongly colour, and semi-vowels sometimes dipthongise, the preceding vowel. Formant frequencies were extracted automatically at the midpoint of the vowel using the mu+ function ‘track’, and then checked manually, as previous experience suggested spurious values are sometimes produced by the formant tracker. Obviously spurious values were eliminated from the data set. A small number of further measurements were added to the vectors using hand measurement of F1 and F2 from spectrograms, in order to obtain sets of more than 30 tokens for each cell. In these tokens, the values of F1 and F2 were taken at the midpoint of the appropriate band of strongest amplitude, and measurements were taken only when such bands were clearly identifiable. Frequency values in Hertz were converted into the auditory Bark scale using the equation \[26.81/(1 + 1960/f (Hz)) - 0.53\] (Traunmüller 1990) and are presented in a format comparable to that in Fletcher and
Evans (in press), which examines the acoustic correlates of accent in the related language Dalabon and the Kun-dedjnenghmi variety of BGW.

4.6 Results

4.6.1 Duration

4.6.1.1 Effect of accent on duration

The results indicate that accent in and of itself does not increase syllable duration in Kuninjku. There is no significant difference between the mean durations of accented and unaccented CV syllables in either the word-initial foot or word-penultimate position (Wilcoxon rank-sum t-test: p>0.05 in both cases). Sufficient data regarding the effect of accent on syllable duration was available only for word-initial syllables in a pre-word-final foot, and word-penultimate syllables. Figure 4.2 shows the respective durations of accented and unaccented syllables in these positions in non-phrase-final words (to avoid potential confounding effects of phrase-final lengthening).

---

4 Only results for open (CV) syllables are reported, as there are insufficient tokens of closed syllables in word-initial, non-final feet and of unaccented CVC syllables in penultimate position in the word to conduct statistical tests.
Figure 4.2: Boxplots showing durations of accented and unaccented CV syllables by word position (phrase-medially). Boxplots show the median value and spread of a distribution, across the four quartiles of values. The area between the first and third quartiles is shaded black. The white line is the median value, while ‘whiskers’ above the fourth quartile or below the first represent outlier values (unusually deviant data points).

Key:
1 = word-initial accented CV (n= 52),
2 = word-initial unaccented CV (n= 41)
3 = penultimate accented CV (n= 35)
4 = penultimate unaccented CV (n= 53)

Interestingly, there is a significant difference in duration between accented word-initial and word-penultimate syllables, on the one hand, and unaccented syllables in each position, on the other. The difference between the means of accented syllables in the two positions is 32 ms (103ms, s.d. 28ms vs 135 ms, s.d. 47ms; Z = 3.35, p.<0.0001) and the difference between the means of unaccented syllables in the two positions is 22ms (125ms, s.d. 35 ms vs 103ms, s.d.28 ms; Z = 3.073, p< 0.05).

These results suggest that both accented and unaccented syllables are slightly lengthened when late in the word, relative to syllables early in the word – or, possibly, word-initial syllables are slightly shortened. The effect of word position is of about the same magnitude in both accented and unaccented syllables. This small, but significant, difference in the duration of accented and unaccented syllables depending on word
position demonstrates the need to control for this factor when examining the effect of
accent on duration in polypedal words.

Although it is problematic to extrapolate from differences between statistical
mean durations to the perception of actual differences in duration between tokens –
especially given the variation about the mean evident in the standard deviations –
differences of this magnitude (32ms/22ms) may be large enough to be perceptible in
syllables of the mean durations given above (between 103 and 135 ms). For a reference
duration of 110ms the Just Noticeable Difference (JND) ratio is 0.196 (Henry, 1948, as
cited in Lehiste, 1970). This means that the JND threshold is a 22ms difference in
duration, equal to or below the average difference in duration between accented and
unaccented syllables in a word-initial foot, compared with accented and unaccented
penultimate syllables.

4.6.1.2 Timing effects within the word: duration of accented syllables in word-initial
position in short and longer words

The durations of accented CV syllables were compared in the underlined positions shown
in (1) and (2) (as mentioned above, square brackets [...] indicate feet, round brackets,
optional elements):

(1) \[
\sigma \sigma \sigma \sigma \quad \sigma (\sigma) \quad ([\sigma \sigma (\sigma)]_F)
\]

(2) \[
\sigma \sigma \sigma \sigma \quad \sigma \sigma \quad ([\sigma \sigma \sigma]_F)
\]

The difference between the two sets of durations is weak, but significant, in the direction
of shorter initial syllables in the longer set of polypedal words (Wilcoxon rank-sum t-test:
Z = 3.0023, p<0.05). The difference between the means is 17ms. Again, however, there is
considerable variation about the means: 101ms (s.d. 29.4ms) vs 118ms (s.d. 25.4ms).

One factor which may affect the duration of word-initial syllables is whether they
are also initial in a higher-level prosodic unit, i.e. an intonational phrase or utterance.
Such units tend be launched into at a particularly rapid speech rate. The two sets of
tokens were therefore examined with respect to whether they are initial or medial in a
phrase, either an IP or an utterance. A higher proportion of the first set of tokens are in
fact initial in an IP or utterance (73%) than the second (35%); therefore it is possible that
the above result is attributable, at least in part, to this factor.

4.6.1.3 Phrase-position effects on accented and unaccented antepenultimate and
penultimate syllables
Figure 4.3 (below) compares the mean durations of accented antepenultimate and
penultimate CV syllables in phrase-final and non-phrase-final conditions. In the phrase-
final condition, there is a strong effect of phrase-final lengthening on the duration of the
penultimate syllable, but not on the duration of the antepenultimate. There is no
significant difference between the two sets of durations in non-phrase-final position
(120ms (s.d. 34.1) vs 135ms (s.d. 46.9), p >0.05; number of tokens = 31 and 35,
respectively).

The difference between the mean duration of penultimate accented syllables in
non-phrase-final position vs phrase-final position is 53 ms (135ms, s.d. 46.9 vs 188ms,
s.d. 42.2). A difference of this size is above the JND threshold for reference durations of
this magnitude. For a reference duration of 175ms, the JND ration is 0.188. This means
the JND threshold is a 32.9 ms difference in duration, well below 53 ms.

Phrase-final lengthening significantly affects both accented and unaccented
penultimate syllables (see Figure 4.4: for the latter, non-phrase-final mean duration is
125ms, s.d. 34.8, vs a phrase-final mean duration of 156ms, s.d. 38.8; Z = 4.1881, p = 0).
However, accented syllables are disproportionately affected by final lengthening, relative
to unaccented. There is a weak but significant difference (32ms) between the means of
penultimate accented and unaccented syllables in phrase-final position (188ms, s.d. 42.2
vs 156 ms, s.d. 38.8; Z = 3.8254, p < 0.0001), such that the accented syllables are longer.
32 ms is close to the perceptual threshold for differences in duration in syllables with a
reference duration of 175ms; accented penults may therefore not always be perceptibly
lengthened relative to unaccented tokens.

There is no significant difference between the mean durations of penultimate
accented and unaccented syllables in non-phrase-final position (p> 0.05).
Figure 4.3: The effect of phrase-final position (IP/Utterance) on the duration of penultimate and antepenultimate accented syllables

Figure 4.4: Increased duration of phrase-final accented penultimate syllables relative to unaccented
4.6.1.4 Phrase position effects on unaccented word-final syllables
The mean durations of word-final unaccented syllables, in final and non-final phrase positions, were also compared. Figure 4.5 indicates that there is no significant word-final lengthening effect upon the final unaccented syllable of the word in phrase-medial position, relative to an unaccented penultimate syllable (125ms (s.d. 34.8) vs 131ms (s.d. 35.7): p>0.05).

However, there is a significant effect of phrase-final lengthening, especially on the final unaccented syllable of words. This is reflected in the large and significant difference (77ms) between the mean duration of word-final unaccented CV syllables in phrase-final and non-phrase-final positions (208ms (s.d. 67.4) vs 131ms (non-final) (s.d. 35.7): Z = 6.0837, p=0) (Figure 4.5). This difference is stronger than the difference between the mean durations of unaccented penultimate CV syllables in phrase-final and non-phrase-final positions. As is to be expected, the effect of phrase-final lengthening is strongest on the syllable closest to the phrase edge, and though still present, is relatively attenuated on the preceding syllable. There were insufficient tokens of phrase-final unaccented antepenultimate syllables for statistical analysis; however, as mentioned above, the
durations of accented antepenultimate syllables showed no effect of phrase-finality (see Figure 4.3).

4.6.2 Peak RMS amplitude

The results show a significant difference in mean amplitude (dB) between the accented and unaccented conditions ($F = 25.86$, $Pr (F) < 0.001$). However, post-hoc pairwise tests (Wilcoxon Rank Sum tests) indicate that the significant difference is contributed by only one of the four vowels, the central open vowel /a/: ($p < 0.001$) (see Figure 4.6 and Table 4.1). None of the remaining three vowels shows an absolute or paradigmatic mean difference in RMS levels between accented and unaccented tokens, although the results for /i/ and /u/ are close to significance at $p < 0.05$ level ($p = 0.051$ and $0.052$ respectively).

The difference in the RMS of /a/ (4.6dB) may be perceptible. Under experimental conditions, a difference of approximately 1dB was found to be just noticeable (Lehiste, 1970: 121).

<table>
<thead>
<tr>
<th>Mean RMS (dB)</th>
<th>/a/</th>
<th>/e/</th>
<th>/i/</th>
<th>/u/</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accented</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>s.d.</td>
<td>4.7</td>
<td>5.1</td>
<td>4.2</td>
<td>4.7</td>
</tr>
<tr>
<td>(no. of tokens)</td>
<td>(52)</td>
<td>(41)</td>
<td>(33)</td>
<td>(31)</td>
</tr>
<tr>
<td><strong>Unaccented</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>s.d.</td>
<td>5.5</td>
<td>5.9</td>
<td>7.2</td>
<td>5.7</td>
</tr>
<tr>
<td>(no. of tokens)</td>
<td>(43)</td>
<td>(43)</td>
<td>(42)</td>
<td>(34)</td>
</tr>
<tr>
<td>$Pr (F)$</td>
<td>$&lt;.0001$</td>
<td>$&gt;.05$ (n.s.)</td>
<td>$&gt;.05$ (n.s.)</td>
<td>$.05$ (n.s.)</td>
</tr>
</tbody>
</table>

Table 4.1: Mean peak RMS of accented and unaccented vowels
The difference in mean peak RMS amplitude between the vowels /e/, /i/ and /u/ and the vowel /a/ emerged only under accent: an ANOVA carried out on the unaccented vowels showed no significant difference in RMS between the four phonemes (Pr (F) > 0.05). That is, no significant differences in intrinsic intensity were apparent between the vowels, in the absence of other potential prosodic influences on intensity, such as metrical strength or accent.

4.6.3 Vowel quality in accented and unaccented vowels

The results indicate that vowel quality is not systematically affected by accent in Kuninjku (Table 4.2, Figure 4.7). In particular, there is no evidence from formant structure that stressed, accented vowels are hyperarticulated. Indeed, the inverse appears to be true in some cases: the vowels /e/ and /u/ are realised as slightly more peripheral (more close) in unstressed and unaccented syllables. The difference between mean F1 in accented vs unaccented vowels for these two phonemes is slight, but significant (for /e/,
\[ \Delta \text{bark} = 0.52 \text{ (80Hz), } t = 2.9514, \ p < 0.05; \] for /u/, \[ \Delta \text{bark} = 0.55 \text{ (82Hz), } t = 3.6742, \ p < 0.001. \]

Impressionistically, the /a/ vowel is also realised as a closer variant in unstressed syllables (and not only where a conditioning factor, such as a following palatal consonant or glide, is present; see Figure 4.10/sound file 4.2). However, the difference between F1 in this vowel in accented and unaccented contexts did not reach significance.

F2 values for the lax vowel /u/ were also significantly lower in the unaccented context than the accented. However, the difference between F2 and F1 (an indicator of backness) was not significantly different between the contexts. Compared with Kuninjku, the sets of F1 and F2 values in Dalabon (Fletcher and Evans, in press) suggest the /u/ vowel is similarly located within the vowel space in both languages.

Significantly, there is no overall tendency for unstressed, unaccented vowels in Kuninjku to be strongly centralised, or to be realised as schwa. The difficulty English speakers have in determining the location of stress in Kunwinjku words (Etherington and Etherington, 1998) may be attributable in part to the lack of regular processes of vowel centralisation and reduction as a correlate of metrically weak syllables.

Figure 4.7: Vowel plot for Kuninjku accented (ai, au, ae, aa) and unaccented (ui, uu, ue, ua) vowels
4.6.4 Other segmental correlates of metrical weakness

In this section, I examine other occasional segmental correlates of metrically weak syllables: vowel elision, syllable reduction and glide deletion.

4.6.4.1 Vowel elision and syllable reduction in metrically weak syllables

In Kuninjku and Manyallaluk Mayali, vowel elision occurs occasionally, either in the first or a medial foot in the word, and usually affects the vowels /i/ or /u/. An example of vowel elision is given in Figure 4.8), in which the second, metrically weak /i/ vowel of the pronominal prefix /birri/ is lost in a token of the word *birri-dowerrinj*. In this token, only the initial syllable [bIr] is accented.

Interestingly, a weak syllable located between two pitch accented syllables appears to be fortified against temporal reduction or elision: it is typically pronounced with unreduced duration and a slightly more peripheral vowel quality than the same vowel in an adjacent accented syllable. An example is the second /i/ vowel of the prefix /birri/ in the word *birri-kayhmeng* (see Figure 4.10).

<table>
<thead>
<tr>
<th>Vowel / formants (number of tokens)</th>
<th>Accented</th>
<th>Unaccented</th>
<th>t.test: **p&lt;0.001, *p&lt;0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>/a/ F1 F2 (n)</td>
<td>6.372647 11.01016 (46)</td>
<td>6.398069 10.98815 (39)</td>
<td>-0.1658 0.1661</td>
</tr>
<tr>
<td>/e/ F1 F2 (n)</td>
<td>5.407934 12.01792 (33)</td>
<td>4.892464 12.00513 (42)</td>
<td>2.9514* 0.1039</td>
</tr>
<tr>
<td>/I/ F1 F2 (n)</td>
<td>3.949888 12.65891 (31)</td>
<td>3.707786 12.70451 (31)</td>
<td>1.6899 -2.848</td>
</tr>
<tr>
<td>/o/ F1 F2 (n)</td>
<td>4.673785 8.874181 (32)</td>
<td>4.124137 7.971421 (35)</td>
<td>3.6742** 3.4602**</td>
</tr>
</tbody>
</table>

Table 4.2: Vowel quality (measurements in barks)
Figure 4.8: Wideband spectrogram showing elision of weak /u/: /b i ɾ i / -> /b i ɾ /

Sound file 4.1: IP-unique token of birri-dowerrinj
Figure 4.9: Double-accented token of the word *birri-kayhmeng*

Figure 4.10: Wideband spectrogram of *birri-kayhmeng*, showing unreduced duration and formant structure in the second /ɪ/ vowel

*Sound file 4.2:* IP-unique token of *birri-kayhmeng*
There are also some patterns of syllable reduction which appear to suggest the presence of a conflict between metrical strength and syllable structure. For example, two reduced forms of the adverbal morpheme -rawoyh- are attested in the speech of a single Kuninjku speaker (MK): -rawh- and -royh-, as well as the full form -rawoyh- (sound files 4.3 to 4.6). Here it would seem there is a conflict, on the one hand, between the relative phonetic weakness of the root-initial open (CV) syllable -ra-, with respect to the following closed (CVCC) syllable -woyh (see Chapter 3, §3.6) and on the other, the underlying metrical strength of -ra- relative to -woyh. Together these pressures give rise to the two alternative reduced forms of the morpheme.

(1) Sound file 4.3: Reduced form -rawh-

(2) Sound file 4.4: Reduced form -royh-

(compare sound files 4.5 and 4.6, with the unreduced morpheme -rawoyh-, below)

Incidentally, the timing of the disyllabic foot rawoyh is largely preserved in the monosyllabic reduced forms rawh and royh. Monosyllabic royh is in fact longer than the disyllabic foot ngane which precedes it, for example (354ms vs 235ms). The same is true of the initial disyllabic foot bene and monosyllabic rawh (150ms vs 185 ms, respectively). The unreduced foot rawoyh is 320 ms in duration (ra(w) is 154 ms long, (w)oyh 162 ms), with the preceding trisyllabic prefix kabene being 370ms long.

4.6.4.2 Glide deletion in metrically weak syllables

In BGW, an intervocalic glide which is the onset of a metrically weak syllable is frequently deleted. For example, in the word kabene-h-rawoyh-bo-rrong (3a-IMM-again-liquid-hitNP: ‘they hit the water again’), the syllable [wɔʔ] is metrically weak, and a wideband spectrogram shows little evidence of a [w] segment between the preceding [a] and following [ɔ] vowels (Figure 4.12, sound file 4.5).
In contrast, when -woyh- is strong in the surface metrical structure, as it is the word rawoyh-no=wanjh (again-POSS=then: ‘So again…’) (Figure 4.12, sound file 4.6), the segment [w] is clearly present as an onset to the now metrically strong accented syllable. The addition of the suffix -no following -woyh allows the construction of an accentable foot beginning with the closed syllable woyh, which then carries accent in place of the initial light syllable of the root, ra (see Chapter 3, section 3.6). In a similar vein, Fletcher and Evans (in press) found that “an absence of consonant lenition in onset and coda positions” is a cue to localised prominence in Dalabon and Kun-dënjëngmi (BGW) words.

Figure 4.11: Wideband spectrogram showing elision of the [w] segment in the utterance kabene-h-rawoyh-borrong.

Sound file 4.5: IP-unique token of kabene-rawoyh-borrong
Figure 4.12: Wideband spectrogram showing a clear [w] segment in the utterance rawoyh-no=wanjh.

Sound file 4.6: IP-unique token of rawoyh-no=wanjh

4.7 Inconsistency of syntagmatic variation in duration, intensity and F0

The results reported in section 4.6 relate to paradigmatic (i.e. absolute) differences in duration, intensity and vowel quality in metrically strong and accented syllables vs metrically weak, unaccented syllables. Syntagmatically, however, it needs to be emphasised that the relative magnitudes of duration, intensity and F0 in accented/stressed vs unaccented/unstressed syllables do not always (or unambiguously) indicate the metrically strong syllable in a foot in BGW. For example, the accent-related F0 peak occurs on the unaccented, post-stress syllable in delayed or late peak accents (see Chapter 5).

With regard to syntagmatic variations in syllable duration, an accented syllable which is initial in a word may be as short or shorter than a following unaccented syllable of similar structure within the foot (see Figure 4.14: initial [b1] = 52 ms, [1i] = 80ms) and also shorter than an accented syllable of similar structure later in the word.
Intensity levels may also remain the same or similar across an accented syllable and an immediately following unaccented syllable within the foot (refer, for example, to Chapter 3, Figures 3.1 and 3.2). It seems that intensity levels do not need to quickly decrease across the unaccented syllable for it to be perceived as metrically weak. However, it is not clear whether this is only the case in rapid speech. Figure 4.13 illustrates from English the phenomenon of the RMS level (indicated by arrows) remaining high across the unstressed syllable in a foot in rapid speech. In this example, the F0 level also remains high past the vowel onset of the unstressed syllable, but drops away rapidly, and the syllable is not perceived as prominent.

Figure 4.13: Token of gotta, showing sustained RMS and F0 peaks on the unstressed syllable

Sound file 4.7

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5 This example is drawn from a subset of the ANDOSL Australian English Map Task speech data (Millar et al., 1990). The intonational labels are my own.
4.8 Discussion

4.8.1 Duration

The variability of acoustic correlates of metrical strength has often been observed in the literature (e.g. Hayes, 1995). The findings of this chapter highlight the importance of determining the abstract phonological system of metrical structure assignment, which underlies and supports the phonetic variability that is its surface manifestation.

In the duration study reported in section 4.6, I did not attempt to separate the potentially distinct effects of metrical strength and pitch accent on syllable duration. However, the results suggest that the durations of syllables vary much more significantly in relation to their position in the phonological word than they do in relation to metrical strength or weakness, with word-initial strong syllables often being exceedingly short. Accented, metrically strong syllables do not show a paradigmatic increase in duration relative to unaccented, metrically weak syllables. This finding is in contrast with King’s (1994) observation that accented syllables in Dyirbal are lengthened relative to unaccented, but similar to findings by Pentland (2000), Pentland and Ingram (2001) and
Harrington et al. (2000) in relation to Warlpiri accented syllables. However, Pentland and Ingram (2001) also found that an accentual lengthening effect was displaced beyond the bounds of the accented syllable, with significant lengthening of the post-accentual consonant being reported.

The perceptual effect of shorter syllable durations word-initially is no doubt enhanced by the fact that the syllable structure of many of the pronominal prefixes and one of the most common noun-class prefixes, the masculine *na-*, is a simple CV. The other most common structure in these prefixes is CVC. The more complex syllable structures (CVCC, CVCCCh) all occur word-medially or finally (see Evans, in press; 1995). Thus, the word-level effects of increasing duration of both accented and unaccented syllables toward the right end of the word in longer words is probably in fact understated by the results reported here, given the predominance of closed syllables in word-medial and -final positions. Only the results of analyses of CV syllables were reported, due to insufficient tokens of comparable closed syllables in most word positions.

That the metrically strong initial syllable of a word may be extremely short in duration (even when acting as the anchor for a pitch accent) also points to the independence in Kuninjku of metrical structure from the processes of temporal reduction. In English, on the contrary, the two are clearly intertwined: systematic temporal and spectral syllable reduction is a consistent correlate of absence of stress, the lowest rung of metrical weakness. Word-initial or -medial metrically weak syllables are, however, susceptible to elision in rapid connected speech in Kuninjku, though no systematic data has been collected on this phenomenon.

An interesting finding reported in section 4.6.1.3 relates to the extra lengthening of syllables which are accented and penultimate in the word and in the phrase (IP or utterance). Word-penultimate syllables are frequently cited in the literature on prosodic and tonal structure as interacting with prominence in a manner that is unique to this position. For example, word-penultimate syllables attract a contour tone in certain tone languages, and additional lengthening in Italian (D'Imperio and Rosenthal, 1999). Penultimate (vowel) lengthening independent of stress lengthening is found in Ammani-Jordanian Arabic (De Jong and Zawaydeh, 1999). Penultimate prosodic prominence thus
appears to be a feature of languages which are otherwise typologically entirely distinct. D’Imperio and Rosenthall (1999) attribute the effect of paradigmatically greater duration in penultimate open syllables in Italian to the combined effect of a difference in the foot structure of these syllables, which are analysed as bimoraic, and stress-related lengthening. However, it is possible that the effect is also in part due to an interaction between penultimate stress and the final position of the word in the utterance, since isolated citation forms were used in the study.

The study by De Jong and Zawaydeh (1999), and the results reported above for Kuninjku, both indicate the necessity of controlling for both phrase and word position when examining the duration of syllables in relation to stress (see also Beckman and Edwards, 1990). De Jong and Zawaydeh’s study is exemplary in examining both “how the durational measures attributed to stress may be influenced by other prosodic factors such as the position of the stressed syllable in the word” and “any possible connection between word-level effects [on duration] and higher-level prosodic structure” (1999:5). De Jong and Zawaydeh found an effect of pre-intonation phrase-boundary lengthening which extends back to the penultimate syllable, the vowel of which is lengthened relative to the vowel of the antepenult. This significant effect of final lengthening on the penultimate vowel, both when stressed and unstressed, was smaller in magnitude than the effect on the final vowel of the word, whether stressed or unstressed.

De Jong and Zawaydeh also distinguished three levels of prosodic boundary strength, IP-medial, IP-final and utterance-final, and reported significant lengthening of the penultimate syllable in both IP-final and utterance-final conditions relative to the IP-medial condition (1999:18). Edwards, Beckman and Fletcher (1991) observe penultimate syllable lengthening in some speakers of English, while pre-boundary lengthening of a word-final syllable is a consistent effect across speakers. Thus there are clear similarities between the prosodic lengthening of penultimate and final syllables observed in Kuninjku and the behaviour of these syllables in two prototypical stress accent languages, Jordanian Arabic and English. King (1994: 65) also found an effect of intonational phrase-final lengthening on the vowel of the final syllable in Dyirbal. However, no word-final lengthening effect, such as Beckman and Edwards (1990) observed for English, was found in Kuninjku.
Another significant issue arises from the effect on syllable duration of the interaction between accent, penultimate word position and phrase-final position. This relates to the question of ‘nuclearity’ or intonation phrase-level prominence. In the citation forms of isolated words, phrase-level prominence corresponds to perceived main ‘word stress’. The results of the analyses presented above point to a conflict between the two principal criteria for ‘main word stress’ assumed in the literature on stress accent languages, as they apply to the dialects of Bininj Gun-wok analysed here.

The first criterion for ‘main word stress’ is that it is the syllable which (under broad focus conditions) attracts a pitch accent, in the situation where there is only one pitch accent assigned to the word. The second criterion is perceived prominence: the ‘main stress’ syllable is generally assumed to be the most perceptually salient syllable of the word. In Kuninjku, the default location of a single pitch accent is the leftmost metrically strong syllable of the word. On the other hand, words are very frequently double-accented, with a second accent being assigned to the metrically strong syllable of the rightmost foot in the word. This syllable is most often the penultimate (or much less frequently, the antepenult). Increased duration due to the interaction between accent and penultimate lengthening in phrase-final position may render the penultimate accented syllable more salient in this context than the shorter, initial accented syllable. What this suggests is that a distinction needs to be clearly drawn between an intonationally-defined End Rule (giving the default location of accent; see Chapter 3, §3.11) and perceived ‘phrasal stress’ or phrasal prominence, which may be a distinct phenomenon. Although a language such as English conflates the two phenomena, other languages, such as Kuninjku, may not.

Finally, while the observations reported in section 4.6 are statistically robust for the speaker MK2, a single speaker cannot represent all the possible patterns of durational variation, and segmental lengthening is one aspect of phonetic production in which significant inter-speaker variation is often recorded. King (1994: 64), for example, found for Dyirbal that “not all syllables occurring with pitch accents, or that are utterance-final, are subject to lengthening and that this phenomenon varied between speakers”. Nakatani, O’Connor and Aston’s (1981) study of the acoustic correlates of rhythm in American English found a word-final lengthening effect in unstressed, non-phrase-final syllables for
only two out of four speakers, while De Jong and Zawaydeh (1999) found “inconsistent stress lengthening” effects among four speakers of Arabic. Therefore these results are to be regarded as preliminary, but as nonetheless setting a direction for further investigation.

4.8.2 RMS amplitude

As mentioned in section 4.3.2, Fletcher and Evans (in press) found a small, but significant effect of stress and accent on RMS levels (measured in dB) across all vowels in the order of 2 – 4 dB. As described in section 4.6.2, the results for peak RMS amplitude across all vowels in this study also showed a statistically significant difference between accented and unaccented vowels. However, post-hoc tests showed that the strongest (and only significant) difference in RMS amplitude between the accented and unaccented conditions in the Kuninjku data corresponds to the most open accented vowel, /a/, with lesser differences between the more closed, less sonorous vowels. This might suggest a ‘hyperarticulation’ effect of accentuation, of the kind observed in English by de Jong (1995), whereby the intensity of open (highly sonorous) vowels is enhanced under accentuation, possibly by increased jaw opening.

4.9 Conclusion

In this chapter I have demonstrated that the cues most commonly associated with phonetic stress do not appear to be paradigmatic correlates of metrical strength in BGW: there are no consistent significant differences in duration, intensity (as measured by peak RMS) or vowel quality between unaccented, metrically weak syllables and accented, metrically strong syllables. The findings of this chapter are relevant to intonational typology, insofar as they indicate that the main phonetic correlates of metrical strength found to be important in the description of other ‘stress accent’ languages – namely, duration, loudness and vowel quality – are not regular correlates of metrical strength in BGW. On present evidence, the primary exponent of metrical structure in BGW is intonational pitch accent.
Chapter 5

Phonological pitch accent type and phonetic realisation: the H* pitch accent, its alignment, and transitions from accents

5.1 Introduction and overview

In Chapters 3 and 4, I discussed factors which condition accent assignment within phonological words, and examined the acoustic correlates of metrical strength in BGW. In this chapter, I examine the phonetic realisation and phonological structure of the most common accent shape in BGW: a simple high peak. Drawing on data predominantly from the Kuninjku dialect, I argue that the high pitch accent, underlyingly /H*/, presents four surface forms. These four forms are differentiated by the alignment of the H tone. The basic form is H*, an accent which peaks medially in the stressed syllable. Three variants with a more restricted distribution are late peak accents, transcribed H*<, which peak in the postaccentual syllable; H*=>, an accent which peaks in the accented syllable, with high F0 spread to the postaccentual syllable; and early peak accents, transcribed >H*, which peak before the vowel onset of the accented syllable. I will argue that the variant alignment of the H tone in H*< and H*=> accents is not directly conditioned by the immediate phonetic or prosodic phonological contexts in which it occurs. This lack of obvious conditioning raises questions as to the phonological status of these variant alignments, which will be discussed in the course of this chapter. In contrast, I will argue that the alignment of the peak in early peak accents, >H*, is directly phonetically conditioned, and therefore these accents are not phonologically distinct from H*.

1 In Chapter 1, section 1.7.3 and Chapter 3, section 3.12.3, I describe two further variants of H*, with respect to the other dimension of tone realisation, scaling: !H* and $H*.
2 The ‘<’ symbol, as used in the ToBI transcription system, points back toward the metrical head with which the high tone is phonologically associated; the ‘>’ symbol points forward to the metrical head with which the high tone is associated.
In this chapter I will also discuss the models of phonetic F0 transitions between tones needed to account for transitions in BGW between two high pitch accents, and between a high pitch accent and a low boundary tone.

A substantial body of literature in the autosegmental-metrical tradition of intonational description addresses the question of what conditions the phonetic alignment of intonational tones with the segmental structure of utterances. This intonational literature, focusing as it does on the fine details of phonetic alignment, differs from the autosegmental literature on lexical tone, in which the factors conditioning the alignment of tones are usually examined only at the level of phonological context (preceding and following tones), and in relation to whole syllables, not sub-parts of syllables (see section 5.2; Kim (1998), a study of H tone alignment in Chichewa, constitutes an interesting exception to this generalisation, and is discussed in section 5.4.2.1; see also Myers (2001)).

It was not possible in this study to test native Bininj Gun-wok speakers’ perceptions of variations in the alignment of F0 peaks related to accentual H tones, nor their judgments regarding the phonological status of such variations (see Chapter 2, section 2.2 for a brief discussion of the issues). However, this chapter seeks to approach the issue of the potential phonological status of such variations nonetheless, from the angle of identifying variation that cannot be phonological. That is, in this chapter I will proceed by a process of elimination. I assume that the phonological status of recurrent variations in peak alignments may be largely clarified by excluding from the picture any variation that is directly and systematically conditioned by the phonetic or prosodic phonological context in which it occurs.

The outline of the chapter is as follows. In section 5.2 I describe in detail the theoretical relationship between the phonetic alignment of tone targets and phonological accent type in the autosegmental-metrical model of intonation. Section 5.3 discusses the relationship between peak alignment relative to syllable structure and distinctive percepts of tone movement, based on findings presented in House (1990).
Section 5.4 draws again on the insights of House (1990) in designating three potentially distinctive categories of H peak alignment in Kuninjku: early, medial and late peak. Discussion of the pattern with medial peak and high tone spread to the postaccentual syllable (H*=>) is deferred to section 5.5. Drawing from the literature on the effects of prosodic context on tone timing (alignment), the research I present in this section examines potential prosodic and phonetic factors conditioning early and late peak alignment in relation to the accented syllable. I also compare three measures of peak alignment (termed ‘peak delay’), to determine if there are any significant differences in the extent to which different measures reveal regular distinctions in alignment (see section 5.4.5.2).

Section 5.5 describes F0 patterns across syllables underlyingly unspecified for tone (accent or boundary tone), patterns referred to as ‘transitions’. I argue that patterns of high F0 sustained at the level of a preceding accent target across one or more postaccentual syllables indicate the necessity of positing the use of a tone-spreading mechanism in Kuninjku intonation patterns, in addition to phonetic interpolation. In section 5.6 I summarise and conclude the chapter.

5.2 Accent type and peak alignment with the metrically strong syllable

As mentioned above, two conceptions of the alignment of tones are current in the autosegmental-metrical literature (Ladd 2000: 47). One, deriving from the lexical tone literature, is that the phonetic alignment of tone targets is simply a consequence of the phonological association of tone(s) with particular syllables, the tonal context, and the nature of the segmental material to which they associate; it is not further specified in itself. Phonetic alignment of this kind has no consequences for the categorisation of a tone sequence: an L H sequence of lexical tones remains the same phonological sequence, however the tone targets phonetically align with the segmental structure.

The other conception derives from recent research in the intonational literature, based on Pierrehumbert (1980), and subsequent work in the AM model by Beckman and Pierrehumbert and others. In this view, phonetic alignment can itself be quite narrowly (and conventionally) specified in relation to the structure of the syllable/s
with which the tone is associated. Quite fine distinctions in the alignment of tone gestures with the metrical structure can feed into categorical (phonological) distinctions of tone sequence – i.e. pitch accent type. Indeed, the phonetic alignment of a tone with respect to a metrically strong syllable is held to be one of the principal sources of evidence for intonational accent type. This is the point of view adopted in this thesis.

As an example, in English, an accent may comprise a linear sequence of two tones, L and H. Depending on the alignment of the tone sequence with respect to the stressed syllable, these two tones define two phonologically distinct accent types: L*+H and L+H*. Perceptually, the tone that is associated with the stressed syllable is the more salient tone. As described in Chapter 1, ToBI-style transcriptions represent this relative salience of one tone by marking that tone with an asterisk, while the other tone is adjoined by a addition sign. Thus L*+H designates an accent with a low tone target predominantly aligned with the stressed syllable and a high tone target in the following syllable, while L+H* designates an accent in which the low tone typically precedes the stressed syllable onset, with the high tone aligned between the onset and the offset of the vowel of that syllable. The tone with the asterisk is commonly referred to as the ‘starred’ tone.

This procedure of diagnosing accent type from the phonetic alignment of the accentual tone(s) has been widely accepted in the autosegmental literature on intonation (though see Arvaniti, Ladd and Mennen (2000) and Ladd (2000) for a recent challenge to the notion that there is necessarily a ‘stronger’ (or starred) tone in a bitonal accent). In practice, however, interpretative problems can arise from phonetic variability in accent tone alignment. Recent studies of a number of languages, including English, have shown that the alignment of accent-related tone targets with respect to the stressed syllable may exhibit considerable phonetic variation. Studies of tonal alignment in English (e.g. Silverman and Pierrehumbert, 1990; Farrar and Nolan, 1999; Pierrehumbert and Steele, 1989; Wichmann and House, 1999), German (Kohler (ed.), 1991; Grabe, 1998; Peters, 1999), Modern Greek (Arvaniti, Ladd and Mennen, 1998) and Chichewa (Kim, 1998), among others, have demonstrated that tonal alignment
may be conditioned by segmental and prosodic factors, phrase position, and discourse-pragmatic factors. Factors such as these, which have determinate effects on tonal alignment in particular languages, need to be discovered and taken into account in the study of new languages. In order to tentatively posit underlying accent categories, in the absence of perceptual data, one must abstract away from any such direct conditioning effects.

The issue of variability in tone alignment is not necessarily restricted to accents with two tone targets of opposite polarity. Studies have indicated that variations in the alignment of a single H peak with respect to the vowel of a metrically strong syllable may produce categorically distinct percepts, and are therefore a potential basis for phonologically distinct accent types (see section 5.3 below in relation to peak alignment in German).

As described in Chapter 2, section 2.3.1, the most common accentual tone in BGW is overwhelmingly a single H tone. This tone is manifested either as a high peak or as an elbow in the F0 trace (Figure 5.1). In this study, the F0 turning point will be referred to as a ‘peak’, whether it takes the shape of an actual peak or an elbow in the trace.

![Figure 5.1: Interpretation of ‘peaks’ and ‘elbows’ in the F0 trace as accent-related H tones](image)

Impressionistically, the accentual H tone in Kuninjku shows certain clear variations in alignment with the relevant metrically strong syllable. This chapter explores potential

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3 See Chapter 1 for arguments in favour of adopting a “concrete” (Ladd 2000: 42) conception of tone in intonational languages.
sources of these variations in prosodic and phonetic contexts, in order to determine the status of the variant alignments: whether they are clearly phonetic, or potentially phonological.

An earlier pilot study (Bishop, Fletcher and Evans (1999)) examined peak alignment in the Manyallaluk Mayali dialect of Bininj Gun-wok; these findings are summarised in section 5.4.2.1 of this chapter. This chapter primarily focuses on the speech of a Kuninjku dialect speaker, MK2.

5.3 Peak alignment in relation to periods of high spectral change

Variations in the alignment of an accentual tone target can have consequences for the perceived pitch of the accented syllable, relative to the pitch in preceding and following syllables. This is particularly true of variations in tone alignment about the vowel onset, for reasons elucidated in House (1990), and is reflected in the number of studies of peak alignment which examine peak alignment before and after the vowel onset. For example, King (1999) finds preliminary acoustic evidence for two high pitch accent categories in Warlpiri, the principal difference between which is the alignment of the high peak before vs after the stressed vowel onset.

The transition from the consonant onset of a syllable to the vowel is a period of high spectral change. The term ‘spectral change’ encompasses “[a] combination of factors such as consonant release, aspiration, rapidly increasing intensity at vowel onset, and rapid formant transitions during the beginning of the vowel…” (House 1990: 32-33). House models spectral change increase in a CVC sequence as peaking in the first 20 - 30 ms after the offset of the initial consonant, with a much lesser peak shortly before the onset of the final consonant. During the CV transition in particular, a listener’s perceptual resources are directed toward the cues to segment identity provided by the spectral change. In addition, because of the high processing load of the transition, sensitivity to fundamental frequency movement qua pitch change is reduced. However, a corollary of this ‘suppression’ of F0 movement sensitivity during the transition is “heightened perceptual attention to pitch level immediately following vowel onset” (House, 1990:64).
A study of peak alignment in German by Gartenberg and Panzlaff-Reuter (1991) provides further support for the relevance of the spectral change hypothesis to the perception of phonological accent categories. Gartenberg and Panzlaff-Reuter present a tripartite perceptual categorisation of accent-related ‘peak types’ in German: ‘early’, ‘medial’ and ‘late’, relative to the stressed syllable matrix (Figure 5.2 below). Subjects in their experiments were asked to categorise tokens from a continuum of peaks shifted rightwards within the stressed syllable (by intervals dependent on the duration of the stressed vowel in each accented word), by making a “forced-choice decision as to whether or not the intonation pattern of the last token matched that of its three [identical] predecessors” (1991: 81).

![Figure 5.2: Early, medial and late peak alignment in German accents (after Gartenberg and Panzlaff-Reuter (1991))](image)

Gartenberg and Panzlaff-Reuter define early peak alignment as a peak reached before the vowel onset of the stressed syllable, medial peak alignment as the peak falling within the stressed syllable nucleus, and late peak alignment as a ‘scooped’ rise into a peak later in the stressed syllable matrix. They find a categorical distinction between early and medial peak alignment, while late peak alignment is perceived as a gradient modification of the same accent type as medial peak.

Unfortunately, Gartenberg and Panzlaff-Reuter’s experiments do not locate the difference subjects perceive between the three ‘peak types’ very precisely. It is quite possible that the difference the subjects perceived between early and medial peaks resides in the complete tonal make-up of the accent (the alignment of both the high,
and the following low, targets), rather than simply the relative alignment of the peak, as Gartenberg and Panzlaff-Reuter assume. However, it is nonetheless likely that the categorical distinction between early and medial/late peak contours they observe depends at least in part on the increased perceptual salience of the high tone in the latter contours, in which the peak comes after the period of intense spectral change associated with the CV transition.

Evidence from Dutch suggests that two accents defined by peak alignment – ‘early falling’ and ‘late falling’ – are phonologically contrastive within hat pattern contours in that language (Rietveld and Gussenhoven, 1995). In Swerts, Bouwhuis and Collier (1994), cited by Rietveld and Gussenhoven (1995), the Dutch early fall is defined as a fall starting 20 ms before the onset of the vowel of the stressed syllable – that is, presumably, between the onset of the syllable and the vowel – while the late fall (observed in the pointed hat pattern as it occurs in Dutch4) begins on average 80 ms after the vowel onset. Given this, it is interesting to note that Rietveld and Gussenhoven interpret the early falling accent in Dutch as a downstepped high accent, compared to the non-downstepped late falling accent. There is evidently a close perceptual relationship between early falling accents and downstepped accents.

Although House’s study does not directly address the question of the perception of falls as ‘downstepped’ or ‘non-downstepped’, his conclusions suggest that a fall beginning prior to the period of spectral perturbation (i.e. during the onset consonant) may cause the F0 of the vowel to be coded as low relative to the height of F0 in the preceding vowel, while a fall which begins after this period tends to cause the F0 to be coded high.

In a normal phrasal context, an F0 value that is ‘low’ relative to a preceding F0 value may be interpreted as a ‘downstepped’ high tone rather than a true low tone. This is particularly likely if the fall continues across the syllable or syllables following the accented syllable onset towards a yet lower value. However, the precise coding of the pitch change will depend upon the local range. If the range is very large and the fall
extends across a number of syllables, whether the fall begins before the syllable onset or after it may effectively matter little: the pitch perceived in both cases may be ‘high’ in relation to the speaker’s baseline or local bottom of her range.

In section 5.4.6.2 I will discuss the relationship between early falling accents and downstep in Kuninjku.

5.4 ‘Early’ and ‘late’ peak alignment in Kuninjku

5.4.1 Phonetic patterns of peak alignment in Kuninjku

The measure of peak alignment is commonly referred to as peak delay. Peak delay is the alignment of a high accent-related pitch peak in relation to the onset of the metrically strong syllable or its rhyme.

In this section, I examine three common phonetic patterns of alignment of accentual H tones in Kuninjku. The first is the ‘late peak’ pattern, labelled H*<. As mentioned in section 5.1, a ‘late peak’ is any accent-related peak which occurs beyond the right edge of the metrically strong syllable, that is, in the postaccentual syllable (generally in the postaccentual vowel). No peaks in the corpus were located beyond the rhyme of the immediate postaccentual syllable.

The second pattern is the ‘early peak’ pattern, labelled >H*, which is defined as any peak occurring before the vowel onset of the metrically strong syllable.

The remaining peaks fall medially within the metrically strong syllable, and are transcribed as H*. The three patterns are illustrated schematically in Figure 5.3. As noted in section 5.1, there is also a fourth pattern of alignment, a syllable-medial peak followed by sustained high F0 across the following syllable. This pattern is much less common than those described in this section, and is addressed later in this chapter (section 5.5.2.2).


4 Note that the pointed hat pattern as defined for Dutch is a single-accent pattern. In the present study, hat patterns are strictly defined as contours involving two accents; thus, the term ‘pointed hat pattern’ as I will use it in relation to Bininj Gun-wok only refers to two-accent, single-peak contours.
5.4.2 Literature on factors conditioning peak alignment

Some of the more important contextual factors described in the literature as affecting peak alignment are the duration of the stressed syllable or vowel and the proximity of the accent to a preceding or upcoming prosodic event. These factors are discussed in sections 5.4.2.1 to 5.4.2.3 below. Peak alignment may also bear a relationship to contour type. This relationship is discussed, with reference to hat pattern contours, in section 5.4.2.4.

5.4.2.1 Segmental effects on peak delay: Stressed syllable/vowel duration

A number of recent studies have found correlations between peak delay and stressed syllable or vowel duration, in languages including English (van Santen and Hirschberg, 1994; Silverman and Pierrehumbert, 1990), Dutch (Rietveld and Gussenhoven, 1995), Modern Greek (Arvaniti, Ladd and Mennen, 1998), German (Grabe, 1998a, b; Peters, 1999), Mexican Spanish (Prieto, van Santen and Hirschberg, 1995) and Chichewa (Kim, 1998). A pilot study of the relationship between peak delay and syllable duration in the Manyallaluk Mayali dialect of Bininj Gun-wok is described in Bishop, Fletcher and Evans (1999). Typically, these studies find a positive correlation between peak delay and syllable duration, such that the longer the syllable, the later the accent peak occurs.
However, they also typically find the positive correlation between duration and peak delay is decreased by an upcoming prosodic event (see section 5.4.2.2 below on the effects of the right-hand prosodic context). The correlation decreases because an upcoming prosodic event, such as an intonational phrase boundary, word edge or another accent, tends to have a distinctly different influence on peak alignment from that exerted by sources of variation related to stressed syllable or vowel duration, such as speech rate, segmental composition and intrinsic segmental durations (Silverman and Pierrehumbert, 1990). An upcoming prosodic event tends to cause retraction of the peak within the syllable.

The existence of a correlation between syllable or vowel duration and peak delay has, incidentally, allowed such correlations to be interpreted as one form of evidence for the phonological anchoring of the accentual tone to the stressed syllable. Kim (1998), Arvaniti, Ladd and Mennen (1998) and Bishop, Fletcher and Evans (1999) examine correlations between syllable/vowel duration and peak delay to help ascertain whether an accentual tone is phonologically associated with the stressed syllable or the post-stress syllable. Kim (1998) describes a phenomenon in the Bantu language Chichewa which has previously been analysed as ‘high (H) tone spread’ from a stressed syllable to an unstressed syllable to the right, and which only occurs in pre-final feet in the phrase. Applying the methods of instrumental analysis, Kim argues that tone spreading, in this case, should be re-analysed as late alignment of the H peak relative to the syllable to which it is phonologically anchored. His reasoning is this: if the H peak moves in conjunction with variations in the syllable duration of both the first and the second H-toned syllables, then this is evidence that the tone bears an association to both, and therefore, evidence for a tone-spreading analysis. If the H tone moves only in conjunction with the syllable duration of the initial H-toned syllable, it bears an association only with that syllable and the peak of the H tone gesture is simply phonetically delayed until the second syllable.

Kim examines the relationship between the durations of the two syllables in question and peak delay from (a) each syllable onset and (b) each syllable rhyme in order to determine whether the H tone has a phonological association with the second
H-toned syllable, as a spreading analysis would suggest. He finds a relatively higher $R^2$ value ($R^2 = 0.775$) for the relationship between the initial syllable duration and peak delay, than that between peak delay and initial rhyme duration, second syllable duration or second rhyme duration. This result suggests that the peaks in this context have a strong tendency to move in synchronicity with the offset of the initial syllable, despite generally falling to the right of that offset. On the other hand, since there is no evidence for such synchronicity with the second syllable, Kim rejects the spreading analysis.

In relation to the Manyallaluk Mayali dialect of Bininj Gun-wok, Bishop, Fletcher and Evans (1999) observed that high pitch accents often reached a peak in the onset or vowel of the post-stress syllable. The data for this study was drawn from two descriptive texts by a single male speaker, PB (PBTXT1 and PBTXT4). The study sought to determine whether the post-stress peaks were phonologically associated with, or anchored to, the stressed syllable or the post-stress syllable. In order to do this, the interval from the stressed syllable onset to the peak ($P_k - C_0$) was correlated with the stressed syllable duration, and the interval from the post-stress syllable onset to the peak ($P_k-C_20$) was correlated with the duration of the post-stress syllable. Strong correlations between the interval $C_0$ to $P_k$ and the stressed syllable duration resulted for the nuclear (phrase-final) condition in both texts ($R=0.97$, $p = 0$; $R = 0.94$, $p<0.0001$) and for the prenuclear (non-phrase-final) condition in one of the texts ($R= 0.77$, $p<0.0003$) (there were insufficient data points in prenuclear position for a statistical analysis of the other text). In contrast, there were no significant correlations in either text between post-stress syllable durations and peak delay from the onset of that syllable. This was taken to indicate that accents rising to a peak in the post-stress syllable were phonologically associated with the stressed syllable. Additionally, the strength of the correlations between peak delay and stressed syllable duration indicate that post-stress peaks occur at a fairly stable distance from the offset.

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5 $R$ is the correlation coefficient, a measure of the strength of the linear relationship between the two variables. $R^2$ is a measure of the extent to which the values of one variable are predictive of those of the other, in this case, the extent to which syllable durations are predictive of peak delay values. A value of .775 means 78% of the variation in one variable is accounted for by the variation in the other.
of the stressed syllable. This seemed to suggest a second anchor point for the accent gesture in the vicinity of the vowel onset of the post-stress syllable.

5.4.2.2 Right-hand prosodic context
Previous studies of stress accent languages have shown that right-hand prosodic context, whether another accent or a prosodic boundary, can exert an influence on the peak alignment of a high pitch accent.

In English and Mexican Spanish, an upcoming accent or prosodic boundary (word or higher level) causes retraction of the accent peak within the stressed syllable, as well as lengthening of that syllable (Silverman and Pierrehumbert (1990) and Prieto, van Santen and Hirschberg (1995)). These effects are statistically significant. They also mean that the simple statistical correlation between peak delay and syllable duration will tend to return a much lower value or be below significance under these conditions. This is in part due to the effect of peak retraction, and in part because such prosodically-conditioned sources of additional syllable lengthening do not cause a concomitant increase in peak delay.

Conditioning of peak alignment by prosodic events in the immediate right-hand context may also occur in tone languages. Kim (1998) explores earlier phonologists’ claims that in Chichewa, “[h]igh tones generally spread forward one syllable, but not onto or within the disyllabic phrase-final foot” (1998: 245). As described above, Kim’s study suggests that default late peak alignment is neutralised in phrase-final feet. This might suggest, in turn, an effect of peak retraction similar to that which has been observed in phrase-final feet in stress accent languages.

Silverman and Pierrehumbert (1990) examined the timing of non-phrase-final (prenuclear) H* accents in English in order to determine whether observed differences in peak alignment in phrase-final vs non-phrase-final positions should be analysed as evidence of two distinct accent types, or only one type, with prosodic conditioning of peak alignment. The study complements Steele (1986), a description of prosodic context effects on nuclear H* accent alignment. Silverman and Pierrehumbert found that an upcoming prosodic event, whether another accent, a word boundary or an
intonation phrase boundary, affects the peak delay (measured as a percentage of the stressed syllable duration), by lengthening the matrix syllable, at the same time as the position of the peak is retracted (Silverman and Pierrehumbert, 1990: 96). This finding suggests that there are identical mechanisms in phrase-final (nuclear) and non-final (prenuclear) positions for adjusting peak location in relation to an upcoming ‘prosodic event’ of either a tonal or non-tonal variety. It also suggests an explanation for the often-observed regularity of earlier peak alignment in phrase-final high accents.

Most relevant here is that the presence of similar effects on peak alignment in phrase-final and non-phrase-final positions allows Silverman and Pierrehumbert to conclude that differences in the average alignment of H* peaks between the two positions is explicable in terms of prosodic conditioning, and that therefore, there is no basis for postulating two distinct accent types.6

Bruce (1983) also describes positional variants of accents in utterance-final and non-final positions in Swedish dialects. Words with final stress in utterance-final position (which obligatorily bear Accent 1) are realised with high tone on the stressed syllable, while in non-final position the stressed syllable carries a low tone. Bruce remarks that

> [c]onsiderations of context-dependent variation in the F0 contours used to evoke prominence indicate that both a change from Low to High and a change from High to Low may manifest the actual accent. (Bruce, 1983: 230-231)

This variation comes about through an adjustment to tone timing (compression of tone targets) which is made with reference to the amount of segmental material available. Differences between the amount of material available in utterance-final and non-final positions results in a different alignment of Low and High tones with the stressed syllable in each context, despite the fact that the underlying accent must be the same in

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6 Notice, however, that this finding does not preclude the existence of functional differences between accents in the two positions; such differences point to interpretative mechanisms which do not necessarily access accent type, but rather, the presence or absence of accent at (structurally significant) points within the intonational phrase. As Silverman and Pierrehumbert comment:

> “this [lack of difference in the accent inventory between nuclear and prenuclear positions] of itself does not do away with the distinction between nuclear and prenuclear as prosodic categories. We believe that the distinction exists in prosodic organisation, but do not find evidence for it in the inventory of English pitch accents...” (1990: 105, n. 16)
each context. Such modifications are, again, clearly phonetically conditioned: the point is that the phonetic appearance of the ‘same’ accent can be quite radically altered by the segmental and prosodic context in which it occurs.7

There has been a small amount of work to date explicitly addressing the role of foot size in relation to variation in peak alignment. Steele (1986) examined nuclear accents in which zero, one or two syllables separated the accented head of a foot from the end of the intonational phrase and found that the peak was slightly later when one or two syllables intervened between the accent and the phrase edge. Similarly, van Santen and Möbius (1999) report that in polysyllabic IP-final accent groups (the accented syllable grouped together with any following unaccented syllables), “peaks occur much later in the initial accented syllable (91%, and often located in the second syllable) compared to monosyllabic accent groups (35%)”. Such variation lends support to a suggestion in Pierrehumbert and Beckman (1988: 159) that pitch accent in English could be regarded as “a foot-level property”, a possibility which arises from the fact that English allows not more than one accent in a metrical foot, while the accent peak may be variably aligned within the foot. In section 5.4.7.5 I examine the relationship between peak delay and foot structure in phrase-initial accents in Kuninjku (refer to Chapter 3, section 3.4 for details of metrical structure assignment in BGW).

The influence of righthand prosodic context on peak alignment, as described in this section, tends to be in a single direction: an immediately upcoming prosodic event tends to push a preceding accent peak leftwards in its matrix syllable. The effects of righthand prosodic context on peak alignment in Kuninjku will be the subject of sections 5.4.5.2 and 5.4.5.3.

5.4.2.3 Left-hand prosodic context
The prosodic context to the left of an accented syllable may also affect the alignment of the accent peak. For example, Farrar and Nolan (1999) examined the effect of the

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7 This point is also illustrated by Grabe (1998) in relation to truncation and compression processes in Northern Standard German and Southern British English.
presence of unstressed and unaccented syllables preceding an accent (= ‘anacrusis’) on accentual peak alignment in British English. They found that anacrusis led to a much greater proportion of peaks being aligned within the stressed syllable rather than in the post-stress syllable(s), while without anacrusis, the opposite was true:

To summarise, only 11.07% of utterances with no anacrusis had the peak occurring within the accented syllable, compared to 66.67% of utterances with anacrusis. Peak lag is therefore more frequent when there is no anacrusis. (1999: 962)

This suggests that English speakers use a longer rise time when the accent falls closer to the left boundary of an utterance, although normalised start-to-peak times were not reported. It may be that English speakers use later peaks in order to reinforce the salience of the accentual rise in a context in which there is no period of contrasting lower pitch preceding the accent. Another interpretation of this finding might be that the initial syllables in the phrase are spoken more rapidly, and are therefore shorter, while the rise time does not change, leading to peak alignments with the post-stress syllables.

Wichmann, House and Rietveld (2000) examined the intonational correlates of topic shift in a five-minute news summary radio broadcast. They found that late (post-stress) peak alignment appeared to be a consistent correlate of topic initialisation, in addition to F0 reset relative to the preceding phrase (2000: 169):

…there was also a clear link between topic-initial IOs [intonational onsets] and a very late alignment of the extra-high F0 peak, which occurred at the end or even beyond the accented syllable. This observation led to the hypothesis that the links between late alignment and topic initiality were predictable.

The ‘left-hand context’ in this case was both pragmatically-defined (topic-initial) and a prosodic edge (an utterance onset, assuming the study’s ‘major tone group’ is equivalent to an utterance-level prosodic unit). In a preliminary study, Wichmann, House and Rietveld found differences in average peak alignment between ‘major tone group’-initial accents in topic- and non-topic-initial positions in the discourse, such that topic-initial accents were on average aligned 20% later than non-initial. These
differences did not reach significance due to the small size of the corpus under investigation.

However, follow-up experiments indicated that lateness of peak alignment does indeed increase with the strength of the ‘initiality’ of a phrase-initial accent in the discourse: “Paragraph or topic initiality exerts a strong rightward push even to the extent of causing the F0 peak to occur beyond the accented syllable itself” (2000: 179). Paragraph-initial accentual peaks were on average aligned at 115.7% of the stressed syllable duration, “sentence”-initial (presumably, utterance-initial) peaks at 105.2% and “sentence-final” peaks at 62.2% of the stressed syllable duration. The difference between these alignments was found to be significant at the 1% level.

Wichmann, House and Rietveld (2000) also suggest that a further distinction should be made between utterance-initial and -medial accents, which are otherwise classed together as ‘prenuclear’ (non-phrase-final) accents. They note that initial accents in the intonation phrase are “typically observed to have a higher F0 than subsequent ones in a defined domain” (2000: 169), and are thus differentiated from following accents within the phrase in terms of scaling. The British tradition incorporates this observation by phonologizing the phrase-initial accent as the ‘intonational onset’. Wichmann, House and Rietveld raise the question of whether similar effects in the timing dimension might not also discriminate between the phrase-initial accent and following prenuclear accents in the utterance unit (2000: 168).

It has been clear for some time that phonetically gradient phenomena such as pitch reset (upward tone scaling) can serve a demarcative function at the levels of the intonation phrase, utterance and ‘discourse paragraph’. Wichmann, Rietveld and House’s study suggests that modifications in the other important dimension of accent realisation, tonal alignment, may also play a demarcative role in marking the onset of a new prosodic unit.

Late peak alignment in phrase-initial positions and early peak alignment in phrase-final positions might, on the surface, appear to be parallel effects. However, certain facts point to the distinctness of the two effects, chief among them the fact that later peak alignment (at least in English) is optionally conditioned by pragmatic
factors such as topicalisation. In contrast, earlier peak alignment phrase-finally appears to be a simpler, systematic phonetic reflex of proximity to a tonally demarcated boundary.

In sections 5.4.7.2 and 5.4.7.3, I examine potential conditioning factors in the lefthand prosodic context in relation to late peak alignment in Kuninjku.

5.4.2.4 Contour type and peak alignment: The hat pattern
The pointed hat pattern contour (described in Chapter 2, section 2.3.1) constitutes what is known as a ‘stress clash’, or more aptly, an ‘accent clash’ context. 8 ‘Accent clash’ is defined as two accents occurring with zero unaccented syllables between them. This prosodic context has been found to induce retraction of the first accentual pitch peak within the stressed syllable in languages including English (Silverman and Pierrehumbert, 1990) and Mexican Spanish (Prieto, van Santen and Hirschberg, 1995). Silverman and Pierrehumbert (1990) find evidence of a gradient effect of accent clash on peak alignment, such that one or two unstressed syllables between accents causes a lesser amount of peak repulsion than is observed when zero syllables separate the accents.

Accent clash has been interpreted in the literature in both rhythmic and gestural terms. In the rhythmic grid model, clash constitutes an instance of arrhythmia, which may catalyse the re-organisation of the relevant prosodic events in order to re-establish an alternation. In the articulatory model, the temporal coordination of adjacent accent gestures constitutes a problem of ‘tonal crowding’ that is resolved by the re-organisation (overlapping or re-alignment) of the articulatory gestures which give rise to F0 changes.

In a discussion of the phonetic correlates of strict (immediately adjacent) accent clash in Mexican Spanish, Prieto, van Santen and Hirschberg (1995) postulate that each of two speakers examined ‘resolves’ clashes in a different manner. Clash is interpreted in their study according to the gestural model. Speaker RS retracts the peak

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8 Frequently, what is referred to as ‘stress clash’ can be reinterpreted as involving accent clash, i.e. a clash at the next higher level of prominence in a grid representation of rhythmic prominence.
of the initial accent and lengthens the accent’s matrix syllable. This strategy apparently aims at allowing the realisation of both adjacent tonal gestures by increasing the segmental space available to (at least) the first gesture, preventing substantial gestural overlap (thus preserving a medial dip in F0 between the accents). Speaker AH, on the other hand, neither lengthens the initial syllable nor retracts its peak to a larger extent than can be accounted for by the proximity of the peak to the right word boundary. The authors observe that “[w]hile RS produced the two clashing accents as two separate rising gestures (with a strong retraction of the first gesture), AH produced them as a separate rise and fall on adjacent syllables (i.e., the rise corresponding to the first accent and the fall to the second accent).” (1995: 442) The implication is that in the hat pattern produced by AH, the alignment of the first accent peak does not differ from the alignment of a single accent peak followed by one or more unaccented syllables (rather than by a second accent gesture). The authors do not discuss the alignment of the second accent peak – that is, whether the fall follows directly after the initial peak or comes after a slight plateau (as in the IPO modelling of Dutch ‘pointed’ hats: ‘t Hart, Collier, and Cohen, 1990). The authors comment in a footnote that “since the two adjacent stressed syllables are perceived as two audible accents, two separate gestures (e.g. a rise and a fall) have to be postulated” (note 16, p.442). This might suggest that the alignment of the second accent peak should be considered as theoretically independent of the first, and therefore susceptible to separate adjustment. Further study of the alignment of the peak(s) in double-accent hat patterns may reveal more about the precise nature of the gestural adjustments made when two distinct accent gestures are combined in a hat pattern (see section 5.4.7.4 in relation to Kuninjku).

Arvaniti, Ladd and Mennen (1998) similarly found that speakers of Modern Greek sometimes modified an expected two-peak contour (with a medial dip) to a pointed hat pattern in a context of tonal crowding (i.e. adjacent accents). They, too, suggest that forming a hat pattern is one among a number of “strategies for coping with having too many accents too close together” (1998: 20). However, the authors do not analyse peak alignment in that subset of accents forming hat patterns.
In their pilot study of peak alignment in the Manyallaluk Mayali dialect of Bininj Gun-wok, Bishop, Fletcher and Evans (1999) note that accentual peaks often occur a substantial distance into the post-stress syllable when the following foot also carries an accent (i.e. in hat pattern contours). The authors refer to this pattern as ‘peak attraction’ in order to suggest a hypothesis of articulatory expediency: that an initial peak in a bisyllabic foot might sometimes be delayed in order to merge with a closely adjacent peak, thus creating a single rise-fall F0 movement out of what would otherwise be two separate rise-fall movements. Such a merger is assumed to minimise articulatory effort, and possibly, be a way of resolving accent clash. However, too few late peak tokens were available in the Manyallaluk Mayali data to properly assess this hypothesis. Clearly, if post-stress peaks regularly occur where there is no following accent, the ‘peak attraction’ hypothesis loses its explanatory force.

Impressionistically, the final accent in Kuninjku hat patterns tends to begin to fall early, in the onset of the accented syllable. This tendency sometimes leads to ambiguity in the labelling of these accents as downstepped or non-downstepped. In section 5.4.5 I examine the nature of the relationship between early peak alignment and the hat pattern contour. I discuss the relationship between early peak accents and downstepped accents in Kuninjku in section 5.4.6.2.

5.4.2.5 Late peak alignment and the interpretation of emphasis

Ladd and Morton (1997) found that later peak alignment is implicated in the interpretation of emphasis. In relation to elicited emphatic and non-emphatic contours, Ladd and Morton observed that

the peak of the emphatic contours was invariably aligned later in the accented syllable than the peak of the normal contours. […] This later alignment appears to be a rather general property of emphatic high accents in English and some other languages… (1997:322)

Manipulating peak alignment to determine if it would affect the location of the category boundary in the identification test mentioned above, Ladd and Morton found that later alignment of the peak was in effect an even stronger cue to contrastive emphasis than the F0 level of the peak, at lower F0 levels. Later peak alignment
overrides F0 as a cue to contrastive emphasis at an F0 level which otherwise leads to interpretation of the accent as non-emphatic. Ladd and Morton remark that “[t]his is consistent with the idea that Late [peak alignment] is intrinsically more emphatic, and has the effect of shifting the category boundary [from normal to emphatic] in a continuum of peak F0.” (1997: 332)

In Ladd and Morton’s study, contrastive emphasis is inferred in tokens with an F0 peak height above a certain level and/or with the peak falling later in the accented syllable, out of a set of tokens with an incrementally increasing continuum of F0 peak heights and peak delay. Wichmann, House and Rietveld (2000)’s findings in relation to late peak alignment also suggest that substantively gradient peak alignment along a continuum from within the stressed syllable to the post-stress syllable may, at some point toward the post-stress or late end of the spectrum, begin to cause the accent to be interpreted as fulfilling a demarcative function (when the accent occurs at the onset of an utterance).

In sections 5.4.7.6 and 5.4.8.3, I discuss the categorical vs gradient nature of late peak alignment in Kuninjku.

5.4.2.6 Measures of peak delay used in the literature

Previous studies have measured peak delay in a number of distinct ways: (1) as an absolute temporal distance (in milliseconds) from the onset of the syllable (e.g. Prieto et al., 1995), (2) as a proportion of the syllable duration (Xu, 1998), and (3) as a proportion of the rhyme duration (Silverman and Pierrehumbert, 1990).

These measures make three assumptions: (1) that peak delay should be measured from the onset of the accent-related rise, that is, from the onset of the accent gesture; (2) that the onset of the accentual rise coincides with a prosodically significant segmental boundary, either the stressed syllable onset or the vowel onset; and (3) that the realisation of the accentual and segmental gestures are explicitly phased in relation to one another, with the phasing either mediated by syllable structure (as in proportional timing) or not (as in absolute millisecond timing).
Xu (1998) describes syllable-proportional timing of peak delay in the following manner:

[S]yllable duration is actually equivalent to the location of the syllable offset relative to the syllable onset, and rhyme duration is equivalent to the location of syllable offset relative to the rhyme onset. Because of this, examining the location of the critical points [i.e. accentual peaks -JB] as a function of syllable duration [as proportional peak delay -JB], in fact, reveals how these points align with syllable onset and offset (1998: 82) [original emphasis]

Even when an absolute measure of peak delay is employed, a short delay from a segment edge has generally been interpreted as indicative of alignment relative to that edge (e.g. Arvaniti, Ladd and Mennen, 1998).

Silverman and Pierrehumbert (1990)’s study of peak alignment in English uses rhyme onset as the reference point for the onset of the accent rise, and they measure peak delay as a proportion of the rhyme duration. However, in a study of Mexican Spanish, Prieto, van Santen and Hirschberg (1995) reject Silverman and Pierrehumbert’s mode of measurement on the basis that, in their data, peak delay is not independent of onset duration: “both a longer onset and vowel trigger a longer peak delay” (1995: 437).

Nonetheless, Silverman and Pierrehumbert’s assumption that the syllable onset has a minimal influence on peak alignment in English appears to be supported by van Santen and Hirschberg (1994)’s finding that “effects [on absolute peak alignment] of onset class [i.e. voiceless, voiced obstruent, sonorant - JB] ... can be explained purely in terms of durational differences [i.e. differences in the duration of the onset - JB]” (van Santen and Hirschberg, 1994:720). This finding means that onset class has no effect on peak delay when delay is measured relative to the rhyme onset.

Studies such as van Santen and Hirschberg (1994), which examine the effects of intrasyllabic segment durations on peak delay, rely on finely controlled data of a kind that is unavailable to the present study, drawn as it is from spontaneous monologue, with uncontrolled variation in speech rate and segmental composition within and between phrases. This study therefore deals only with the relatively gross measures of syllable and vowel duration in relation to peak delay. A positive aspect to the use of
such measures is that clear distinctions in peak alignment which emerge from the ‘noise’ of segmental and speech rate variation are necessarily quite robust.

In the same way that the voicedness of syllable codas affects vowel duration in some languages and not in others (a systematic phonetic difference), it is a priori a possibility that the rhyme onset might function as the anchor point for accent gestures in one language (or dialect) and the syllable onset in another. It is also a possibility that in any given language, a proportional measure of peak alignment might more successfully predict peak location than an absolute measure. For example, proportional measures are more apt to uncover regularities in alignment in relation to the edges of the prosodic constituent in question, be it the entire stressed syllable, the rhyme or the vowel, which may be obscured by variation in the absolute peak delay. Thus regular alignment in the range of 0 - 10% of the syllable or vowel would suggest anchoring to the left syllable or vowel edge; regular alignment in the range 40 - 60% would suggest a syllable-medial target, and so forth (Xu, 1998).

The better performance of either absolute peak delay or proportional peak delay in linear regression models predicting peak location in a particular language or dialect may also be an indication of the relative balance of syllable duration effects, prosodic context effects, and segmental anchoring constraints on peak location. Prieto, van Santen and Hirschberg (1995) note that the predictive strength of their model of peak delay in Mexican Spanish accents “.increased 15-30% by using absolute peak delay as a measure of peak timing instead of syllable proportion, even though the latter measure performed better in Silverman and Pierrehumbert’s database [of English].” (emphasis added) On the other hand, Arvaniti, Ladd and Mennen’s (1998) study of prenuclear rising accents in Modern Greek, while using an absolute measure of peak delay, discovered that the alignment of the peak of a rising (LH) accent occurred a short, relatively fixed distance from the onset of the postaccentual vowel, and was unaffected by the duration of the postaccentual syllable. Segmental anchoring effects such as this may be more clearly evident from proportional than absolute measures of peak delay. While the overall duration of the peak delay could vary considerably depending on the duration of the stressed syllable, the proportion of the peak delay
would show less variability; it would be consistently a small percentage over 100% of the stressed syllable duration.

In studying peak alignment in non-controlled materials, such as spontaneous narrative speech, it is necessary to find ways of incorporating into the data set syllables with non-sonorant onset and coda consonants, in order to avoid excluding considerable amounts of data. One such strategy is the use of interpolation to locate a peak in the presence of F0 perturbation. Voiceless segments and certain other segments, such as nasals, give rise to local F0 perturbation which can prevent direct observation of the accentual peak. Howie (1974, cited in Xu, 1998: 200) argues that “because there is much F0 perturbation in the early portion of a syllable due to the initial consonant, the domain of a tone is limited to the rhyme of the syllable”. However, such a position would imply that the F0 change which occurs during the syllable onset is irrelevant to tone perception, and this does not appear to be the case.

Xu (1999) argues against excluding the syllable onset, noting that in Mandarin, “immediately after the offset of a syllable the F0 contour begins to move toward the first target of the next tone”. The syllable onset in Mandarin is not necessarily voiced; the suggestion is that the presence of F0 perturbation in the vicinity of an F0 turning point does not invalidate locating the F0 turning point at that position, on the basis of interpolation. This suggests that turning point is not always the perceptual crux of the contour; what is perceptually distinct about a contour may be a closely controlled epiphenomenon of (a) the location of the relevant tone targets and (b) the interaction of the contour with different kinds of segmental material. House (1990), whose detailed study describes the effects of segment boundaries (periods of high spectral change) on the perception of tonal movement, provides further evidence for this view. House’s findings suggest that the precise coordination of tone targets with segmental material is manipulated by the intonational phonology of languages to give rise to categorically distinctive percepts of tone change.
5.4.3 Aims of the study

The aim of the research presented in this chapter is to examine possible sources of variation in peak alignment in Kuninjku. Two potentially distinct variations from medial peak alignment, ‘late peak’ and ‘early peak’, are examined in detail in order to determine, in a preliminary fashion, whether these variations relate to phonological, systemic differences in pitch accent type, or merely represent the range of phonetic realisational differences within a single H* category that are available in Kuninjku.

As discussed in section 5.1, if differences in peak alignment are to be potentially phonological, they must not be explicable as the prosodically or phonetically conditioned variants of a single category. Such variants may be acoustically distinct, yet are phonologically derived from the same accent. Studies of tonal alignment in (predominantly) stress accent languages have found a number of contextual factors which affect the phonetic alignment of accent-related high tones. Contextual factors which have been found to correlate with later peak alignment relative to the phonologically accented syllable are: increased duration of the accented syllable; the presence of unaccented syllables preceding the first accented syllable in an intonation phrase or utterance (anacrusis); utterance initial position; topic initiality and emphasis. The principal contextual factor which has been found to correlate with earlier peak alignment is the presence in the immediate right-hand context of an upcoming prosodic event, such as another accent or an intonation phrase boundary.

In sections 5.4.5 to 5.4.6 I examine whether any of the above-listed factors condition the early and late variants in H peak alignment observed in Kuninjku.

I also postulate that another source of late peak alignment could be the presence of a ‘leading’ Low tone target, i.e. if the accent were not H*, but L+H*. This hypothesis is examined in section 5.4.7.3. The need to realise another tone target on the available segmental material could result in the H* target being realised somewhat later, even in the post-stress syllable, particularly if there were no unstressed syllables between the initial phrase edge and the initial accent. If this was the case, H* and

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9 Very few studies deal with the alignment of low tones.
L+H* might contrast in phrase-initial position, with the presence of an initial low target and the relative lateness of the peak being correlates of the L+H* accent type.

5.4.4 Design of the research and materials

5.4.4.1 Classification and labelling of the data

The data set for the analysis of both early and late peak accents comprised two Kuninjku narrative texts by speaker MK2, BILLABONG and CUCKOO. A total of 267 H peaks were analysed statistically. The same intonational patterns were observed in all three narrative texts by this speaker, and in the conversational text.

Accented syllables were labelled for syllable onset, vowel onset, peak location, peak type, vowel coda and syllable coda.

A set of labels for ‘peak types’ was devised in order to analyse factors conditioning early and late peak alignment (see Figures 5.4 to 5.6). Impressionistically, the principal environment for early peak alignment is the hat pattern contour: early peaks typically occur as the final accent peak in the contour, which is also the final accent in the phrase in each case. Therefore the alignment of phrase-final accents which belong to a hat pattern contour were contrasted with phrase-final accents which do not, in order to test the hypothesis that significantly earlier peak alignment is correlated with the hat pattern contour. Since both the hat pattern and the non-hat pattern accents precede a low boundary tone, the difference in the contour is the only contrast in prosodic context between the two groups of accents. The two sets of accent peaks were accordingly labelled as ‘hat pattern, phrase-final’ and ‘non-hat pattern, phrase-final’.

A priori, there is no reason why the second peak in a hat pattern should not begin to fall as late in the metrically strong syllable as a non-hat pattern peak. While peaks in the latter condition tend to have a short rise through the stressed syllable, peaks in the former condition could simply be preceded by a slightly longer high plateau, as the final accent (the ‘A’ fall) appears to be in the Dutch non-downstepped flat hat (‘1A’) pattern (’t Hart, Collier, and Cohen, 1990: 155). Therefore the fact that
these final hat-pattern peaks did appear to fall consistently earlier in the syllable seemed worthy of investigation.

Figure 5.4: A ‘hat pattern’ peak on wirriwirriyak (second accent in the word), followed by a ‘non-hat pattern’ peak on nuye. (Both peaks are aligned prior to the vowel onset in this example, as indicated by the diacritic >.)

Transcription: wirriwirriyak nuye
Gloss: black-faced.cuckoo.shrike his
Translation: ‘The wife of black-faced cuckoo-shrike.’

Sound file 5.1

Two other peak classifications relate to accents which are initial or near-initial in a phrase: ‘non-late peak’ and ‘late peak’. ‘Non-late’ peak accents are always followed by other accents within the phrase. ‘Late peaks’ are usually followed by other accents but are occasionally the only accent in the phrase (see Figure 5.6). No peaks in the corpus were located beyond the rhyme of the immediate post-stress syllable. The number of peaks analysed in each peak type category is shown in Table 5.1.

<table>
<thead>
<tr>
<th>Peak type</th>
<th>Number of tokens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-late peak</td>
<td>100</td>
</tr>
<tr>
<td>Late peak</td>
<td>74</td>
</tr>
<tr>
<td>Hat pattern</td>
<td>42</td>
</tr>
<tr>
<td>Non-hat pattern</td>
<td>51</td>
</tr>
</tbody>
</table>

Table 5.1: Sample size for each peak type
Figure 5.5: A ‘non-late’, utterance-initial peak on *njamed*, followed by a ‘non-hat pattern’, phrase-final peak on *nakkanj*.

Transcription: njamed nakkanj
Gloss: what’s-it  MA.DEM.
Translation: ‘What’s the name of that one?’

Sound file 5.2

Figure 5.6: A ‘late peak’ accent on *birri-wam=wanjh*.

Transcription: birri-wam=wanjh
Gloss: 3aP-goPP=then
Translation: ‘They went, then.’

Sound file 5.3
5.4.4.2 Measurement of F0 at the rise onset and peak in late peak accents

For the set of late peak accents, measurements were taken of the F0 height at the rise onset and peak (see Figure 5.16), and the distance between the two in milliseconds. This was done in order to examine the hypothesis that later alignment in these accents may be due to the presence of a leading low tone. The F0 height at rise onset and peak was measured in a total of 35 late peak accents from across four texts by Kuninjku speaker MK2 (BILLABONG, CUCKOO, NAMALADJ and KUNKURRNG). Only accents with a sonorant onset consonant (nasal, liquid or glide) were chosen, in order to minimise perturbation of the contour and thus facilitate pinpointing the low point of the onset rise.

5.4.4.3 Measures of peak delay

Since opinions in the literature vary as to the appropriate metric for peak delay, three measures of peak delay were compared across the present set of data: (a) from the onset of the syllable, in absolute millisecond time; (b) from the onset of the syllable, as a proportion of the syllable and (c) from the onset of the vowel, as a proportion of the vowel. The vowel was chosen for the latter measure rather than the rhyme since many codas in Kuninjku are voiceless, or unreleased stops.

5.4.4.4 Problems related to peak location and detection of segment boundaries

Waveforms and spectrograms were used to locate segment edges with relative accuracy. However, there were a number of segmental contexts in which it proved impossible to locate the edge, and such tokens were discarded. These included some boundaries between the semi-vowels [w] and [j] in syllable onset position and a following or preceding vowel, and some boundaries between rhotics (as either syllable codas or onsets) and vowels.
Locating a peak was also difficult in particular segmental circumstances (cf. Silverman and Pierrehumbert, 1990: 79). These included final falls in which the onset of the stressed syllable was a voiced or voiceless obstruent (see Figure 5.7 below), where the onset of the fall is rendered unclear by perturbation of the F0 trace. In these cases, the peak was either taken to be the first point at which the pitch began to fall consistently (in a more or less linear movement) following the vowel onset; or, if the perturbed gap in the F0 trace was small and the inferred movement of pitch between the pre-stress syllable offset and the stressed syllable vowel onset was linear, then the peak was taken as occurring at or close to the syllable onset. This method uses an assumption of more or less linear interpolation between tone targets in a mid pitch-range.

In other cases, the small extent of the accentual pitch movement made it difficult to distinguish the peak from microprosodic movements with certainty; in such cases, the accent token was omitted.

Difficulties in locating the accent peak arose principally with the intonation phrase-final accents, which generally peak early in the stressed syllable. As described in section 5.4.4.1 above, these accents were divided into two types: accents which constituted the falling accent of a hat pattern (pointed or flat) and those which did not.

The procedure adopted in the analysis of peak alignment of hat pattern and non-hat pattern peaks was as follows. Where the preceding syllable ended in a sonorant or vowel, and on the assumption of continuous F0 movement, pitch movement was interpolated between the end of the preceding syllable and the first point of unperturbed pitch movement in the next. This procedure revealed the location of a turning point.

Difficulties arose, however, when the preceding syllable also ended in a voiceless consonant, or a nasal segment, the final section of which was frequently perturbed in the F0 trace. In this situation, no unambiguous interpolation could be made. In this case, the first unperturbed F0 point was identified and labelled as the peak. In terms of the validity of the analysis of difference in alignment between hat pattern and non-hat pattern peaks, the most likely result of these approximations
would be to underestimate the difference between the categories. That is, hat pattern peaks in particular would tend to be labelled later than their actual location. Though non-hat pattern peaks do sometimes occur in the onset consonant of the stressed syllable, they also frequently occur at and beyond the midpoint of this syllable, while hat pattern peaks rarely do (refer to Table 5.2, section 5.4.5.1 in the results section).

![Figure 5.7: Perturbation of the F0 trace in the nasal offset of ben- and the onset of -kerre-attributable to the voiced velar stop /g/ (orthographically ‘k’).](image)

Transcription: ben-kerre-bom
Gloss: 3/3pl.-ground.oven-hitPP
Translation: ‘He/she cooked them in the ground oven.’

Sound file 5.4

![Sound file 5.4](image)

5.4.5 Results: Early peak alignment in Kuninjku

5.4.5.1 Average peak alignment of hat pattern vs non-hat pattern accents

Hat pattern and non-hat pattern accents were found to have significantly different mean peak alignment across all three measures of peak delay, in combined data from the BILLABONG and CUCKOO texts (see Tables 5.2, 5.3 and Figures 5.8, 5.9).

These findings show that the hat pattern has a significant effect on the peak alignment of the second accent in the pattern, in the direction of earlier peaks within the syllable.
Table 5.2: Differences in mean peak delay/mean peak percentage of syllable/vowel duration by peak type (Wilcoxon Rank-Sum Tests (non-parametric test)).

The large standard deviations about the means for each measure indicate a fairly wide distribution of peak alignments within the syllable in both the hat pattern and non-hat pattern categories. Not all hat pattern peaks were aligned before the vowel onset of the stressed syllable, and not all non-hat pattern peaks were aligned past the vowel onset. However, there was a strong tendency in this direction. Table 5.3 below shows the proportion of peaks which were aligned prior to the vowel onset of the stressed syllable in each context (hat pattern/non-hat pattern).

Table 5.3: Percentage of peaks aligned before the vowel onset (= ‘early peak’)

<table>
<thead>
<tr>
<th>Peak Type</th>
<th>% peaks aligned before the vowel onset</th>
</tr>
</thead>
<tbody>
<tr>
<td>hat pattern</td>
<td>79</td>
</tr>
<tr>
<td>non-hat pattern</td>
<td>43</td>
</tr>
</tbody>
</table>
Figure 5.8: Peak delay in CUCKOO text: three measures (from left to right: absolute peak delay, peak delay as a proportion of the syllable, and as a proportion of the vowel) (1 = non-late peak accent, 2 = late peak accent, 3 = non-hat pattern accent, 4 = hat pattern accent)
Figure 5.9: Peak delay in BILLABONG text: three measures (from left to right: absolute peak delay, peak delay as a proportion of the syllable, and as a proportion of the vowel) (1 = non-late peak accent, 2 = late peak accent, 3 = non-hat pattern accent, 4 = hat pattern accent)
5.4.5.2 Effects of the right-hand prosodic context: Prosodic boundary strength and distance in syllables from the boundary

In terms of the tonal environment, the right-hand prosodic context is the same for both hat pattern and non-hat pattern accents: an upcoming low boundary (Lₚ or Lₚ-%). However, the strength of the upcoming prosodic constituent boundary was not controlled for in the labelling of these accents and extraction of peak delays. In order to securely attribute the comparatively earlier peak delays found in the preceding section for hat pattern peaks (relative to non-hat pattern peaks) to the effect of that contour alone, it is necessary to exclude other possible sources of increased peak retraction in the hat pattern peaks.

To begin with, the strength of the upcoming boundary may have effects on peak alignment (see section 5.4.6.3). Silverman and Pierrehumbert observed for English that “peaks are absolutely earlier if the words that bear them are in nuclear position [utterance-final position in the study - J.B.] than if they are prenuclear.” (1990: 96) They attribute the additional earliness to the fact that phrase-final syllables are subject to the “greatest amount of prosodic lengthening and so we would expect peaks on these syllables to be correspondingly earlier.” (1990: 96)

In Kuninjku, significant constituent-final syllable lengthening effects are only found at the level of the utterance, not the IP or Phonological Phrase levels (see Chapter 5, section 5.5). Correlations between syllable duration and peak delay mean that such differential lengthening effects of different constituent boundary types may affect peak delay in phrase-final accents. As Silverman and Pierrehumbert observe in relation to English (1990:90),

Conspicuously, those environments in which peaks are early correspond to those environments in which prosodic lengthening occurs. This leads us to suspect that peak placement is related to the temporal structure: whatever it is that triggers prosodic lengthening may also affect proportional peak location.

In light of this, a post-hoc check was carried out on the distribution of prosodic boundary types for the hat pattern and non-hat pattern sets of peaks. This check showed the distribution to be very similar for each set, and that moreover, the great
The majority of the upcoming boundaries are utterance boundaries. The similarity of the distribution of upcoming prosodic boundary types means that this factor is unlikely to have skewed the results presented in section 5.4.5.1 toward earlier mean peak alignment in hat pattern accents.

<table>
<thead>
<tr>
<th>BILLABONG/ CUCKOO texts</th>
<th>% Upcoming Prosodic Boundary Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Type</td>
<td>Phonological Phrase</td>
</tr>
<tr>
<td>Hat-pattern</td>
<td>6</td>
</tr>
<tr>
<td>Non-hat pattern</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 5.4: Percentage of phrase-final accents preceding each prosodic boundary type

However, there is another variable which may have affected the results: the actual distance of the accent from the boundary. This, too, was not controlled for, for either group of accents. Studies such as Steele (1986) and Silverman and Pierrehumbert (1990) indicate that not only the type of upcoming boundary, but the proximity of the accent to that boundary in syllables, can determine how strongly the alignment of a phrase-final accent peak is affected by the upcoming boundary. Because of this, it is conceivable that the average difference in peak alignment between the two sets of peaks might have arisen from a bias in the data. Such a bias could occur if more hat pattern accents happened to situated closer to an utterance boundary than non-hat pattern accents. This possibility can, however, be ruled out. Table 5.5 shows that this variability is unlikely to have distorted the statistical measures of difference cited in section 5.4.5.1. The peaks most likely to be affected by peak retraction caused by the upcoming boundary are those which fall within one or two syllables of the boundary. The data reveals the following distribution of hat pattern and non-hat pattern peaks:
Distance from utterance boundary (in syllables) | Number of hat pattern accents in this position | Number of non-hat pattern accents in this position
--- | --- | ---
0 | 3 | 9
1 | 28 | 26
Total | 31 | 35

Table 5.5: Number of hat pattern and non-hat pattern peaks in utterance-final and penultimate syllables

Since more non-hat pattern accents than hat pattern accents are found at a distance of zero or one syllable from the utterance boundary, it is clear that the distribution of these sets of accents relative to the boundary has not biased the data towards a finding of earlier peak alignment for hat pattern than non-hat pattern accents. The comparatively earlier peak alignment of the hat pattern accents can be attributed with certainty to the contour itself.

5.4.5.3 Effects of right-hand prosodic context: Average peak alignment in phrase-initial vs phrase-final accents

In the preceding section, we have seen that average peak alignment is earlier in hat pattern-final accents than in non-hat pattern-final accents, when both are in phrase-final position. In addition, non-hat pattern H* accents in phrase-final position align comparatively earlier than non-late peak H* accents in phrase-initial position (Table 5.6). In combined data from the BILLABONG and CUCKOO texts (both by speaker MK2), a statistically significant difference is observed in the average alignment of the two groups of accent peaks across all three measures of peak delay.

---

10 Phrase-initial/final here means initial/final in either an intonation phrase or an utterance.
Table 5.6: Comparison of the average difference in peak delay between phrase-initial, non-late peaks and phrase-final, non-hat pattern peaks (Wilcoxon Rank Sum test)

<table>
<thead>
<tr>
<th>Peak Types</th>
<th>Mean absolute peak delay from accented syllable onset (ms)</th>
<th>Mean peak delay as a % of the accented syllable</th>
<th>Mean peak delay as a % of the accented vowel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-late peak (phrase-initial)</td>
<td>118.2 (s.d. 44.9)</td>
<td>67.2 (s.d. 20.8)</td>
<td>70.1 (s.d. 49.8)</td>
</tr>
<tr>
<td>Non-hat pattern (phrase-final)</td>
<td>96.8 (s.d. 47.9)</td>
<td>48.3 (s.d. 21.9)</td>
<td>18.5 (s.d. 35.0)</td>
</tr>
<tr>
<td>Significance of the difference in peak delay</td>
<td>p &lt; .001</td>
<td>p &lt; .001</td>
<td>p &lt; .001</td>
</tr>
</tbody>
</table>

5.4.6 Discussion

5.4.6.1 The effect of contour type on peak alignment

The hat pattern and non-hat pattern peak types are distinguished by global contour type: hat pattern accents form the right edge of a hat pattern, while non-hat pattern accents generally have both a rising and falling transition to and from the peak. The significant mean differences in peak delay between the hat pattern and non-hat pattern groups shown in Table 5.2 can be attributed to this difference in global contour type.

There are two possible explanations for the pattern of early peaks in hat patterns. The first is that the peak alignment is phonologically mediated, in the manner described by Silverman and Pierrehumbert for prenuclear/nuclear variation in peak alignment in English:

In this approach, the phonetic implementation process does not have direct access to the hierarchical prosodic structure. Rather, the phonetic rules can only refer to an intermediate phonological representation in which those structural characteristics that are responsible for the observed phonetic differences have been explicitly re-encoded. (Silverman and Pierrehumbert, 1990: 77)

In relation to the hat pattern, this would mean that the pattern itself, with its two consecutive high pitch accents, constitutes an ‘intermediate phonological representation’ which is phonetically interpreted across the available segmental material. Such a representation would directly specify the alignment of the final high tone target, and possibly the initial tone target, within the pattern.

284
The second explanation involves a hypothesis about the nature of the processes of phonetic implementation: that in a string of tonal commands, the accomplishment of one command initiates the onset of the next. In the case of a (non-upstepped) final accent in a hat pattern, the F0 height of the accent has already been reached, since the previous F0 value is spread up to the point of association of the following accent (see section 5.5 for discussion of tone spreading in Kuninjku). Thus, the peak has been ‘accomplished’ at the onset of the stressed syllable, and the next tonal command – a low tone associated with the upcoming boundary – takes effect immediately, causing the F0 to begin visibly and audibly falling in the vicinity of the vowel onset of the syllable. Although the phonological mediation hypothesis cannot be ruled out, it does not have any clear advantage over the second hypothesis, and it would have the disadvantage of giving global contour shapes an ontological status in the phonology for which there is, at present, little other justification.

On the basis of the above findings, I consider the ‘early peak’ accents to be a phonetic variant of syllable-medial peak alignment, principally occurring when the accent is final in a hat pattern. Early accents occur frequently in this context simply because the target level of the accent has already been reached at the onset of the syllable.

5.4.6.2 Early peak vs downstepped accents in Kuninjku hat patterns

In Kuninjku early peak accents, the F0 is falling throughout the stressed vowel (see, for example, the second accent in Figure 5.4). Such an ‘early fall’ in F0 may cause the pitch during the vowel to be perceived as ‘low’ relative to the pitch of the preceding syllable (House, 1990). Nonetheless, there appears to be a difference between early peak accents (phonologically H*) and true downstepped accents (phonologically !H*) in Kuninjku.

Phonetically, the difference between early peak and downstepped accents in Kuninjku lies in the height of the accent peak relative to the F0 level in the preceding syllable. In the early peak accents (see Figure 5.10 and 5.11), the fall begins at the same height as the preceding high F0. Where the onset of the accented syllable is
voiceless, it is possible to infer a simple linear interpolation from the end of the sustained high pitch to the visible onset of the fall.

In contrast, a true downstepped second accent, as shown in Figure 5.12, generally does not allow a simple interpolation between the preceding high pitch and the onset of the fall (see section 5.5.2.1). The compression of the !H* target is such that the onset of the fall begins from a clearly lower value than the preceding sustained high pitch level. Thus a distinction therefore needs to be maintained between ‘early falling’ accents and ‘downstepped’ accents when labelling intonation in Kuninjku, and the transcriber must be wary of mistaking a percept of ‘downstep’ attributable to early peak alignment for a true downstepped accent.

Figures 5.10 to 5.11 illustrate two ‘early peak’ accent patterns in Kuninjku, in two tokens of the same word. In Figure 5.10, the fall begins at the syllable onset, in Figure 5.11, at the vowel onset. Both syllables have sonorant onsets, and both are transcribed H* (the label ‘>’ is used to indicate a phonetically early peak). Figure 5.12 illustrates a ‘true’ downstepped accent in an otherwise similar hat pattern, again within a single verbal word.

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**Figure 5.10:** ‘Early peak’ pattern with F0 falling from the stressed syllable onset (non-downstepped final accent on *nga-wurlebme*).

Transcription: *nga-wurlebme* = wanjh  
Gloss: 1-swim=then  
Translation: ‘I’ll go swimming then.’

*Sound file 5.5*
Figure 5.11: ‘Early peak’ pattern with F0 falling from the stressed syllable vowel onset: non-downstepped final accent in *nga-wurlebme*.

Transcription: nga-wurlebme ngaye

Gloss: 1-swimNP 1

Translation: ‘As for me, I’m going swimming.’

*Sound file 5.6*
5.4.6.3 Effects of phrase position on peak alignment

As shown in section 5.4.5.3, there is an effect of phrase-final (IP or utterance-final) position on peak alignment in Kuninjku. This effect is similar to that found by Steele (1986) and Wichmann, House and Rietveld (2000) between phrase-initial and phrase-final accents in English.\(^\text{11}\) In Steele (1986), the difference in alignment is found in relation to the position of the accent in the Intonation Phrase. Regardless of the precise prosodic level in question, it is interesting that a pattern of earlier accent alignment in a phrase-final position is observed in two languages as typologically distinct as BGW and English.

\(^{11}\) Wichmann, House and Rietveld (2000) use the terms “sentence-initial” and “sentence-final”, which are difficult to interpret in terms of the prosodic phrase levels discussed in this thesis, but may refer to the utterance level.
Although the IP and utterance levels of phrasing were not distinguished in the present experiment, the observed effect of phrase-finality on the proportional alignment of the accent peak within the matrix syllable is likely to be attributable in part to final lengthening, which affects syllables within the final foot of utterance-final words (see Chapter 6, §6.5). Silverman and Pierrehumbert (1990) observe that increases in syllable duration due to right-hand prosodic context, such as a final lengthening effect, do not cause a concomitant increase in peak delay (1990:75), thereby leading to earlier proportional delay within the affected syllables.

5.4.7 Results: Late peak alignment in Kuninjku

There is a highly significant, positive correlation between the peak delay of accents with late peak alignment and the duration of the accented syllables in Kuninjku (p=0, R=0.8551); see Figure 5.13 below. That is, peak delay increases as the duration of the accented syllables increases.

Figure 5.13: Correlation between syllable duration and peak delay in late peak accents in Kuninjku
5.4.7.1 Late peak accents and utterance-initial position

Late peak accents occur almost exclusively in utterance-initial position in Kuninjku. They very occasionally occur in non-initial position, when a second, emphatic accent is phonetically upstepped in relation to the initial accent (see Figure 5.15). Late peak accents also tend to occur in emphatic utterance-initial accents (see Figure 5.14). There were no examples in the corpus of late peak accents in intonation phrase-initial but utterance-medial position.

Figure 5.14: Illustration of an emphatic late peak accent in Kuninjku (on the prefix bene-).

Transcription: bene-yirri-yoy=wanjh
Gloss: 3ua/3pl-scattered-liePP=then
Translation: ‘Then the two of them lay them out’.

Sound file 5.8
Transcription: ngudda=wanjh ngune-bo-rro
Gloss: you=then 2ua-liquid-hitIMPER.
Translation: ‘So you two, you strike the water [to frighten away crocodiles]’.

Sound file 5.9

### 5.4.7.2 Effects of left-hand prosodic context: Anacrusis

In Kuninjku, late peaks still occur when there is anacrusis. 8 tokens out of 74 late peak tokens from the BILLABONG and CUCKOO texts had anacrusis, and the alignment of these peaks ranged from early to late within the post-stress syllable. This suggests that the lateness of the peak is not conditioned by the proximity of the accent (in syllables) to the initial utterance edge. If it were, we might predict that alignment within the stressed syllable would be more frequent whenever the initial accent was preceded by one or more unaccented syllables. This does not appear to be the case.

The anacrusis effect on peak alignment observed for English is apparently a language-specific phonetic realisation effect not shared by Kuninjku.
5.4.7.3 Effects of left-hand prosodic context: Leading low tone as an explanation for late peak alignment

The acoustic evidence for or against the characterisation of late peak accents as L+H* is inconclusive. The results of the data analysis showed a strong correlation between the height of the rise onset and the height of the peak (p=0, R = 0.804), as illustrated in Figure 5.16 below. Approximately 64% of the variation in the F0 height of the rise onset was accounted for by variation in the height of the peak. This indicates that the rise onset and the peak ‘move together’ – the higher the peak, the higher the rise onset – and does not support the presence of a relatively stable low tone target. In emphatic accents included among the Kuninjku late peak tokens, it was particularly clear that the F0 level of the whole accent is raised. In these accents, the onset of the accent was sometimes as high as 200-250Hz (see Figure 5.17 for the range of onset values). These findings are comparable to those produced by Aufterbeck (2002), who examined the relationship between the onset height and the peak height of utterance-initial rising high accents in a variety of Scottish English, and likewise found a strong correlation between the two (R = 0.82).

However, the literature suggests that the F0 height of the onset in an L+H* accent need not be absolutely low or relatively fixed at a low level in the speaker’s range. Pierrehumbert (1980) observed that the F0 level of the L tone in the accents she labelled L+H* tended to increase as the height of the H tone increased: “…in some cases, H’s drag L tones upward with them. Specifically, a L tone in a bitonal accent goes up as a ratio of the value of the H.” (1980:75) The onset height of an ordinary H* accent will also rise with an increase in the height of the peak. Thus the F0 height of the onset of the accent rise is not sufficient in itself to determine whether an accent should be analysed as H* or L+H*. In studies of tonal alignment, evidence that two tone targets are closely temporally aligned is taken to be suggestive of a bitonal complex. It is not clear that dependency in terms of scaling carries the same implication.
Figure 5.16: Correlation between peak F0 and onset F0 in Kuninjku late peak accents

Figure 5.17: Mean peak and rise onset height (Hz) in Kuninjku late peak accents
There was no significant correlation between the size of the F0 change from the rise onset to the peak and the rise duration (p>0.05). This means that the rise in late peak accents does not have a consistent, or characteristic, slope in terms of which it might be differentiated from that of non-late peak accents. There is, however, a medium strength but highly significant correlation between the height of the peak and the slope, such that a higher peak involves a steeper rise (p<0.001, r = 0.558).

There is therefore no unambiguous quantitative diagnostic for the presence of a leading low tone target in late peak accents in utterance-initial position\(^{12,13}\).

However, there is some qualitative evidence which indicates that the later peak alignment in Kuninjku late peak accents is not attributable to the presence of a low lead tone. The few ‘upstepped’ late peak accents in the corpus, which directly follow the first accent in the phrase, do not show a dip in F0 level prior to the second rise, but a plateau spreading at a sustained high level from the initial accent target (see section 5.5.2.1 for illustrations of this contour). I postulate therefore that late peak accents comprise a single phonological H tone. The question remains whether the late alignment of the H tone is distinctive, or whether it is conditioned by phonetic or prosodic context, and therefore non-distinctive by default.

### 5.4.7.4 Effects of right-hand prosodic context: Tonal crowding in hat pattern contours

Late peak accents in Kuninjku are found even when only one syllable precedes a following accent, as occurs in some hat pattern contours. This means that ‘tonal crowding’ due to the proximity of the two accent gestures does not necessarily cause retraction of the initial peak (see section 5.4.2.2 above). Impressionistically, post-stress syllables are also not significantly lengthened in a tonal crowding context (in order to increase the separation of the two accent gestures).

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\(^{12}\) As described in Chapter 3, section 3.10, there is, however, clear evidence for L+H* accents in utterance-medial (and word-medial) position.

\(^{13}\) Qualitatively, the source of a low target preceding the initial accent in utterance-initial position may also be ambiguous: it might be due to an initial low boundary tone %L, for example.
To determine whether there are any effects at all on the alignment of an initial accent peak due to its occurring in a hat pattern, measurements were taken of the peak delay of late and non-late peaks, in initial position in hat pattern and non-hat pattern contours. Using the Wilcoxon rank-sum test, no statistical difference was found between the peak delay of non-late peak accents which are the first accent in a hat pattern and those which are not (p>0.05), or between late peak accents which are the first accent in a hat pattern and those which are not (p>0.05).

In Kuninjku, accents frequently peak in the post-stress syllable in the absence of a following accent (see, for example, Figure 5.6 above). This means that late peaks are also not simply conditioned by a strategy of ‘merging’ an initial peak with a following peak to form a single rise and fall.

5.4.7.5 Effects of right-hand prosodic context: The distribution of late peak accents in relation to foot structure

Another aspect of the right-hand prosodic context relevant to the analysis of late peak accents is the proximity of the right foot boundary. In this section I discuss the relationship between the presence or absence of following unstressed syllables within a foot, and late peak alignment.

In the course of examining the relationship between accented syllable durations and peak alignment, it was found that the average duration of the metrically strong syllables associated with late peak accents was substantially shorter than for non-late peak accents (Wilcoxon Rank-Sum Test, Z=7.54, p = 0).
A count of distinct syllable structures for both accent types showed that CV syllables predominated in the late peak accent category, while there was a more even distribution of the most common syllable types, CV and CVC, among accented syllables in the non-late peak accent category (Table 5.7). However, since late peak accents occur, though more rarely, with CVC accented syllables, and conversely, non-late peak accents occur with CV syllables, there is no simple conditioning of in- or post-stress syllable peaks by the segmental structure of the accented syllable.

An examination of the durations of CV and CVC syllables associated with late and non-late peak accents revealed that late peak CV syllables were also significantly shorter on average than non-late peak CV syllables (Table 5.8). The difference in the average duration of late peak CVC syllables and non-late peak CVC syllables did not reach significance, but was suggestive of a trend in the direction of shorter average durations for late peak CVC syllables. The lack of significance is most likely attributable to the small number of tokens in the late peak CVC category.

<table>
<thead>
<tr>
<th>Syllable structure</th>
<th>Late peak</th>
<th>Non-late peak</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n.</td>
<td>%</td>
</tr>
<tr>
<td>CV</td>
<td>63</td>
<td>84</td>
</tr>
<tr>
<td>CVC</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>CVh</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CVV</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CVVC</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CVVh</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CVCh</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>CVCC</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>V</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>VC</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>75</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 5.7: Syllable structure of metrically strong syllables associated with late and non-late peak accents in BILLABONG and CUCKOO texts.
The data presented in Table 5.9 shows that the shorter average duration of late peak CV accented syllables compared to non-late peak CV accented syllables is largely attributable to the foot structure of many of those syllables. All late peak CV syllables and most late peak CVC syllables belong to a polysyllabic foot. Conversely, a substantial number of non-late peak syllables constitute monosyllabic feet, as indicated by the presence of an accent on the following syllable (CV syllables: number of monosyllabic feet = 7; CVC syllables: number of monosyllabic feet = 21), or even monosyllabic words (number = 5).

The figures in Table 5.9, while in some cases based on only a few tokens, suggest that syllable length is adjusted according to whether or not the syllable is isomorphic with a higher level prosodic constituent, the foot or the phonological word. Syllables within a polysyllabic foot are on average shorter than syllables which constitute a monosyllabic foot, which in turn are shorter than those which constitute both a monosyllabic foot and word. (The difference in duration between non-late peak and late peak CV syllables which are the heads of polysyllabic feet (non-late peak syllables are longer than late peak, Z=3.75, p = 0) is more difficult to explain; it may be attributable to a syllable duration adjustment for the peak falling within the bounds of the stressed syllable.)

These findings suggest that a proportion (approximately one-fifth) of non-late peak accents peak within the stressed syllable because the following syllable is also accented (i.e. the non-late accented syllable forms a monosyllabic foot), and a peak delay beyond the stressed syllable could be construed as accent only on the second metrically strong syllable and not also on the first.
<table>
<thead>
<tr>
<th>Syllable structure</th>
<th>Late peak</th>
<th>Non-late peak</th>
<th>Late peak</th>
<th>Non-late peak</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CV</td>
<td>CV</td>
<td>CVC</td>
<td>CVC</td>
</tr>
<tr>
<td>Average duration (ms)</td>
<td>112</td>
<td>155</td>
<td>157</td>
<td>193</td>
</tr>
<tr>
<td>Wilcoxon Rank-Sum</td>
<td>Z = 4.94,</td>
<td></td>
<td>Z = 1.89,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>p=0</td>
<td></td>
<td>p&gt;0.05 [n.s.]</td>
<td></td>
</tr>
</tbody>
</table>

Table 5.8: Duration of late peak and non-late peak CV and CVC accented syllables in BILLABONG and CUCKOO texts

<table>
<thead>
<tr>
<th>Syllable structure</th>
<th>Late peak</th>
<th>Non-late peak</th>
<th>Late peak</th>
<th>Non-late peak</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CV</td>
<td>CV</td>
<td>CVC</td>
<td>CVC</td>
</tr>
<tr>
<td>Average duration, head of a polysyllabic foot (ms)</td>
<td>112</td>
<td>143</td>
<td>137 (n=5)</td>
<td>167 (n=8)</td>
</tr>
<tr>
<td>Average duration, monosyllabic foot within a word (ms)</td>
<td>–</td>
<td>182</td>
<td>206 (n=2)</td>
<td>199</td>
</tr>
<tr>
<td>Average duration, monosyllabic word (ms)</td>
<td>–</td>
<td>288 (n=1)</td>
<td>–</td>
<td>246</td>
</tr>
</tbody>
</table>

Table 5.9: Duration of late and non-late peak CV and CVC accented syllables in BILLABONG and CUCKOO texts, by prosodic structure

5.4.7.6 The unimodal distribution of late and non-late peak alignment
So far, we have seen that late peak alignment in Kuninjku is not directly phonetically conditioned by left- or right-hand prosodic contexts. It also does not appear to be attributable to a distinct accent type with a leading low tone (L+H*). On the other hand, the circumstances in which late peak accents can occur are positionally constrained: they typically occur in utterance-initial position, and only rarely (and in association with upstep, and therefore emphasis) in second position. They are also
evidently constrained by foot structure. None of these findings as yet suggests clear evidence for or against the phonological vs phonetic status of late peak accents.

Acoustic distinctiveness may provide initial evidence for a categorical distinction in accent type (cf. King, 1999). In terms of the acoustic dimension of peak delay, Figure 5.18 shows that absolute peak delay in late and non-late peak accents in Kuninjku constitutes an acoustic continuum. When the peak delay measurements for late and non-late peak accents are combined, the distribution is clearly, and quite narrowly, unimodal.

![Figure 5.18: Combined distribution of absolute peak delay (ms) in late and non-late peak accents](image)

The above continuum fits a description Pierrehumbert and Steele (1989) – in a study of peak alignment in L+H* vs L*+H accents in English – give of “a continuum model in which peak delay is continuously variable but a central value is preferred” (1989:186). The distribution of absolute peak delay values therefore provides no evidence for an acoustically distinct category of late peak alignment.
5.4.8 Discussion

5.4.8.1 Stability of the rise onset point
In the majority of the late peak accents, the onset point of the rise coincided with the syllable onset, and in all but two instances, the rise onset fell within 5-10ms of the syllable onset. Clearly, the stability of the rise onset observed in a number of alignment studies also holds true of rising accents in Kuninjku (cf. Arvaniti, Ladd and Mennen, 1998 for Modern Greek; Caspers and van Heuven, 1993 for Dutch; Prieto, van Santen and Hirschberg, 1995 for Mexican Spanish, among others). In two instances, the speaker began the transition to the accent peak from the onset of a preceding unaccented word. The words in which this occurred (la ‘and’, wanjh ‘then’) are both connectives which could plausibly be construed as prosodically procliticised to the following word (wanjh is also frequently encliticised). In these instances, then, the accent rise began from the onset of the phonological word, rather than the accented syllable. The two onsets usually coincide. The accentual rise also occasionally began in the sonorant syllable coda of the word preceding the accented syllable.

5.4.8.2 Utterance-initial position and late peak accents
While neutralisation of late peaks due to timing ‘pressure’ exerted by the need to realise an upcoming boundary tone might explain their absence from phrase-final feet, it does not explain why they are not found as regularly in utterance-medial words or feet as in utterance-initial. Impressionistically, utterances with three or more accented words are somewhat less frequent than shorter utterances in the Kuninjku texts analysed. The disparity in the frequency of occurrence of utterance-medial and utterance-initial late peak accents might therefore be attributable, at least in part, to the relative infrequency of utterance-medial accents per se. The other possibility, discussed in the following section, is that the relative frequency of late peak accents in utterance-initial position corresponds to a pragmatic (demarcative) function associated with the relatively longer rise time of these accents.
5.4.8.3 Late peak accents, phonetic gradience and meaning

The place of acoustically gradient modifications of pitch accents in intonational phonology has been discussed in a number of studies (Ladd, 1983a; Ladd and Morton, 1997; Gussenhoven, 1984, 1999; see also Hirschberg and Ward, 1992. These studies have examined modifications in both of the principal dimensions of phonetic tone realisation: scaling and alignment. Ladd and Morton (1997) conducted perceptual experiments to test for a phonological distinction between ‘normal’ and ‘emphatic’ accents in English, citing the distinction between High and Overhigh tones in certain African languages (1997:316). They found that “the normal/emphatic distinction may be ‘categorically interpreted’ but not categorically perceived.” (1997: 313). Under instructions intended to elicit a linguistic mode of response from their subjects, results of identification tests for normal vs emphatic accents showed an S-curve, or clear categorical identification of emphasis. On the other hand, results of pairwise discrimination tests failed to show the expected peak in discrimination at the border of the identified categories. Such a peak appears in the classical categorical perception test when applied to segmental phonological differences. That is, there was little evidence in support of pairs of accents being discriminable on the basis of psychoacoustic cues in the isolated stimuli, yet there was evidence of a bimodal (categorical) interpretation of stimuli.

Ladd and Gussenhoven have both argued that gradient variation in peak alignment deserves further investigation, as it appears that acoustically gradient modifications in both dimensions can sometimes lead to discrete inferences. Nonetheless, the phonological status of an accent which gives rise to an interpretation of ‘emphasis’ or provides a cue to the onset of a new phrase remains poorly understood. A boundary tone which demarcates a phrase-final edge is clearly phonological, but the pitch reset or late peak alignment which serves to demarcate the initial edge of the phrase is not so evidently phonological, since it is only a modification of a phonological event (a pitch accent).

A notion of surface phonological modifications of underlying intonational tones is developed in the alternative AM intonational model proposed by
Gussenhoven (1984) and applied to Southern British English and Standard Northern German by Grabe (1998). Gussenhoven’s modifications are manipulations of four phonetic variables: “timing” of an accent tone in relation to the text; “stretching” of the syllables onto which a tone or tones are mapped (also called ‘stylisation’); “completion” (relating to truncation of a tone gesture part-way through its usual trajectory); and “shrinking” (compression of pitch range). Completion and shrinking are evidently related to complex issues of pitch range modification, while stretching involves a modification of elements in both the segmental and the tonal tiers (see Chapter 2, §2.3.6, in relation to stylisation in BGW and other Australian languages). The kind of modification at issue in relation to peak alignment, however, is clearly timing of the accentual peak. Gussenhoven refers to late peak alignment in relation to the accented syllable as ‘delay’.

Gussenhoven’s concept of “semantic meanings” in this article correlates with what I would call pragmatic, attentional phenomena. He states that, in English, “[t]he meaning of the modification delay is: ‘This manipulation is very non-routine, very significant’”. (1983:218). He also claims that “delay is a gradual modification… the degree of the meaning of the modification (non-routineness) would appear to correlate with the degree of delay.” (218) These two claims are contradictory, on the face of it. The first statement says that ‘delay’ is recognisable as such, that is, categorically; while the second statement suggests that the meaning of ‘delay’ is ‘gradient’ in the same manner as the acoustic realisation is gradient. However, I believe these two claims are in fact compatible (a position also cogently argued for in Ladd, 1996: 282). Beyond a certain threshold of acoustic delay, a listener may make a categorical interpretation of intentional delay: i.e., that “this manipulation is very non-routine” in Gussenhoven’s terms. Thereafter, delay may be gradiently increased, and the hearer’s perception of the degree of ‘non-routineness’ intended by the delay may increase, but the grounding recognition is still that ‘delay’, a categorical concept, is intended.

Therefore, despite the acoustic gradience of peak alignment between late and non-late peak accents in Kuninjku, there may be meaningful inferences associated with this late alignment. Gussenhoven (1999) proposes that ‘unused phonetic space’ may
form the basis of within-category variation that can give rise to discrete inferences, while not acoustically discretised. Such ‘phonetic space’ exists within a polysyllabic foot associated with a single high accent.

On the one hand, late peak alignment in Kuninjku is often distinctly audible as a rise in pitch between the stressed syllable and the post-stress syllable, particularly in emphatic tokens (refer to Figure 5.14, sound file 5.8). This audible difference is in fact predicted by a model of tone movement such as House (1990)’s. In the case of late peak accents, the F0 of the accented syllable is likely to be coded as ‘low’ relative to the higher F0 of the postaccentual syllable, in instances where the late peak is reached after the vowel onset and the brief subsequent period of intense spectral change. That is, the discontinuity introduced by the syllable boundary may enhance the percept of rising pitch in late peak accents, relative to non-late peak accents.

On the other hand, acoustic evidence provides no basis for the categorisation of these late peak accents as distinct from H* accents, since the position of the high peak appears to occupy a continuum of alignments between the stressed syllable and the post-stress syllable.

Thus, while there is no compelling acoustic evidence of phonological categories in accent type dividing late and non-late peak accents in Kuninjku – the distribution of peak alignments is not bimodal – such gradient alignment may nonetheless be subject to discretising interpretation. If this is the case, the two categories thus distinguished would not be underlyingly phonologically distinct, but distinct at the ‘surface phonological’ level, in the same manner as the modifications Gussenhoven proposes.

The underlying phonological element is the same for late and non-late peak accents: a high tone which associates phonologically with the stressed syllable, that is, /H*/. The late peak accent, H*<, is a modification of the underlying /H*/ accent which is phonotactically restricted to occurring in utterance-initial and upstepped feet. The kind of meaning this phonological modification would appear to carry is not semantic, but pragmatic, a kind of attentional signal.

Although a surface phonological level is posited, there are clear problems in corroborating such a hypothesis with native speaker intuitions. Since the kind of
meaning involved is not contrastive, but demarcative and attentional, it is much less likely to be accessible to (untrained) native speaker intuitions than contrastive kinds of meaning. The kind of ‘boundary strength’ perception tests which have been carried out by Swerts, Bouwhuis and Collier (1994), for example, are unlikely to be transferable to work on field languages in the Australian context. Elderly speakers in particular could not be expected to grasp the highly abstract focus of attention required by the researcher.

5.4.9 Summary

This section of the chapter has discussed in detail the alignment of high pitch accent-related peaks in Bininj Gun-wok. In it, I have used a process of elimination to distinguish potentially phonological variation in the alignment of the accent-related peaks from phonetically conditioned variation, through an examination of the prosodic and segmental contexts in which this variation occurs.

Peaks were found to occur earlier in the metrically strong syllable (with median alignment being at the vowel onset) when the accent is final in a hat pattern, than when it is final in the phrase, but not part of a hat pattern. I have argued that the reason for this tendency relates to phonetic realisation: the height of the peak of the accent has already been reached in the preceding pitch plateau, and therefore, no further rise is required for the execution of the second accent. This variation is phonetically conditioned, and not attributable to a distinct accent type.

The phonetic realisation of the early peak accents was also distinguished from a true downstepped peak accent, in final accent position in the hat pattern.

Accents in which the accentual peak is reached in the metrically weak, postaccentual syllable were also examined in order to determine what, if any, contextual factors condition this late alignment of the peak. There appear to be none which exert a direct influence on the phonetic alignment of the peak. In the absence of such direct conditioning factors, I have argued that the late peak accent may correspond to a ‘surface phonological’ modification of the underlying /H*/ accent.

The results showed a phonotactic constraint on the occurrence of late peaks, which only occur in utterance-initial position or as the second (but phrase-non-final)
accent in a upstepping sequence of high accents. However, non-late peaks do occur in utterance-initial position, hence, there is no clear conditioning of late peaks by the preceding prosodic boundary.

The structure of the foot with which the accent associates appears to have an influence on how late the peak of the accent can be achieved. If the foot is monosyllabic, a peak which occurs beyond the edge of this foot may be interpreted instead as an accent on the following foot. This fact tends to constrain the alignment of peaks associated with monosyllabic word-initial feet to within the initial foot.

The results also showed that the absolute peak delays of late and non-late peaks form an acoustic continuum. It is possible nonetheless that the discontinuity in F0 perception introduced by the syllable boundary in the middle of the late peak rises may result in a categorically distinct percept from that of rises not interrupted by a syllable boundary (cf. House, 1990). If late peak rises can be categorically perceived, they may be interpreted as one cue to the onset of a new utterance, or as a cue to emphasis.

5.5 Post-accentual sustained high pitch

In this section, I examine representational issues relating to models of F0 transition across postaccentual syllables which are underlyingly unspecified for tone. I will argue that a tone-spreading mechanism is needed to account for certain patterns of sustained high pitch after a high pitch accent peak that are observed in Kuninjku.

In section 5.5.1 I discuss the distinction between phonetic interpolation and tone spreading developed in Pierrehumbert (1980), and applied in Pierrehumbert and Beckman (1988). Section 5.5.2.1 and 5.5.2.2 describe four kinds of contour in Kuninjku in which high pitch is sustained following a high pitch accent. In section 5.5.2.3 I discuss issues particular to the representation of postaccentual high pitch in Kuninjku, and in section 5.5.3, I briefly address the issue of OCP constraints on adjacent identical tonal specifications in relation to the hat pattern. Section 5.6 concludes the chapter.
According to the phonetic interpolation rules described in Pierrehumbert (1980), phonetic interpolation between tone targets may be monotonic (linear or quasi-linear) or non-monotonic (Pierrehumbert 1980:70). Interpolation between two tones of opposite polarity (H and L or L and H), and also between two L tones, is proposed to be monotonic, while interpolation between two H tones is postulated to be non-monotonic by default.

Pierrehumbert’s example of apparent non-monotonicity is the ‘dip’ or ‘sag’ between two high accents in an English hat pattern. This dip appears when the accents are sufficiently separated in time (Pierrehumbert 1980: 70). However, final evidence is not yet in as to whether or not this ‘dip’ is attributable to actual non-monotonicity or in fact, to an relatively high-scaled (or ‘over-shot’) Low tone between the accents (for arguments bearing on the latter position, see Ladd, 1996: 105-108; Ladd and Schepman, in press; also Grice and Savino, 1995, on Bari Italian)). In other contexts, non-monotonic interpolation between tone targets may reflect physiological constraints on F0 change associated with the speaker’s range (such as ‘floor’ (or baseline) and ‘ceiling’ (or topline) effects).

The assumption of non-monotonicity between high accents in (the English) hat pattern has meant that the more ‘marked’ interpolation is generally taken to be the one in which pitch is sustained at the same level between the H targets. Thus, one proposal has been that monotonic interpolation between H* accents does occur, but in an “elevated but compressed pitch range” (Beckman and Pierrehumbert, 1986; this suggestion is critiqued in Ladd, 1996: 105-108, 274). In BGW, however, monotonic interpolation between H* accents within a hat pattern appears to be the norm, rather than a marked option. This is so even when the initial and final accents are separated by a large number of syllables (Figure 5.19).

Pierrehumbert’s model predicts that the stretch of high F0 in a transition between two high accents (whether or not it ‘sags’) may span any amount of segmental material within the phrase: a syllable, several syllables or even a number of
words. The domain of transitional high pitch only varies according to the distance between the accents.

<table>
<thead>
<tr>
<th>tones</th>
<th>H*&lt;</th>
<th>H*</th>
<th>H*</th>
<th>Lp-‰</th>
</tr>
</thead>
<tbody>
<tr>
<td>words</td>
<td>bani</td>
<td>weleng</td>
<td>bepbe</td>
<td>marne</td>
</tr>
<tr>
<td>breaks</td>
<td>100</td>
<td>150</td>
<td>200</td>
<td>250</td>
</tr>
</tbody>
</table>

Figure 5.19: Hat pattern in Manyallaluk Mayali.

Transcription: bani-weleng-bepbe-marne-yaw-bu-rr-iny
Gloss: 3uaP-then-separately-BEN-baby-hit-RR-PP
Translation: ‘Then the two of them fought each other over the baby.’

*Sound file 5.10*

A tone spreading analysis requires the presence of a single tone target, which is multiply associated across a stretch of tonally unspecified syllables, as shown below. The primary, phonological association line is the unbroken line; the remaining, dashed lines indicate secondary associations.

Tone-spreading (multiple associations from a single tone)
Phonetic interpolation, on the other hand, requires by definition two adjacent tone targets which are separated in time, in order to implement a phonetic path between them. Unlike tone spreading, interpolation has no representation in the autosegmental model: it does not create an additional level of tonal specification, but is considered an effect purely at the level of phonetic interpretation. In contrast, tone spreading is a surface derivation, which provides a surface specification for the tone of segments underlyingly unspecified for tone, via the addition of association lines.

Whether a tone spreading or a phonetic interpolation model is adopted in order to explain F0 patterns across tonally unspecified syllables has important consequences for the underlying tonal representation, i.e. whether one or two tone targets are required to explain the surface F0 patterns. This was recognised by Pierrehumbert (1980: 245) in concluding her study of English intonation:

Different accounts of interpolation could give rise to different tonal analyses of particular contours, and so a more thorough study of interpolation is important both to a phonetic and a phonological account of intonation.

Pierrehumbert (1980) discusses differences in the realisation of F0 transitions predicted by a tone spreading vs a phonetic interpolation analysis in relation to the English phrase tone plus boundary tone sequence L-L%. She argues that if the transition between the low phrase tone and the low boundary tone was carried out by tone spreading from the low phrase tone up to the low boundary tone, “[o]ne would expect to find an F0 plateau somewhat above the baseline with a sudden drop to the lower valued L% at the end”. However, “the fall from L- to L% is gradual, suggesting that tone spreading does not occur.” (1980: 221-222)

In this case, a phonetic interpolation mechanism predicts a linear (monotonic) transition between the tone targets, whereas a tone-spreading mechanism predicts that the phonetic F0 level of the first (i.e. the spreading) tone will be maintained up to a following tonal specification or prosodic boundary, at which a rapid ‘drop’ to the next tone target will occur.

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14 See Beckman (1991) in relation to the term ‘phonetic interpretation’.
There are two other important issues relating to tone-spreading and interpolation as described in Pierrehumbert (1980). The first is the relationship between ‘tone type’ and the ability of a tone to spread. The second issue relates to the phonetic context in which tone spreading can occur.

Pierrehumbert (1980) explicitly adopts the stance that accentual tones associated to metrically strong syllables do not spread, and this claim has generally been accepted in the literature. Only unassociated, ‘floating’ edge tones, such as the English intermediate phrase boundary tone or ‘phrase accent’, and the leading or trailing tones of bitonal accents (which are similarly considered ‘unassociated’) are deemed able to spread within a stress accent language. Arguments against the tone spreading of accentual tones are, however, hard to come by in the literature – the stipulation against such spreading is often simply cited without argument, as it is in Pierrehumbert (1980). It may also be the case that arguments against accentual tone spreading which are pertinent in one type of accentual language do not hold up for another type.

One of the consequences of the constraint against starred tones spreading is that Pierrehumbert (1980) is forced to describe sustained high pitch following a high pitch accent in terms of a distinct pitch accent, H*+H−. The H trailing tone spreads instead of the preceding H* tone:

\[ H^*+H^- \text{ is responsible for patterns in which the F0 on unaccented syllables maintains the high level of a preceding accented syllable, instead of dipping as between } H^* \text{ accents.} \] (Pierrehumbert 1980: 219; emphasis added)

Thus the introduction of the new accent type – H*+H− vs H* – is justified on the basis that there are two patterns of transitional behaviour between accents – dipping and non-dipping – which need to be accounted for.

Pierrehumbert (1980: Ch.5) also argues that tone spreading can be blocked or enabled by the phonetic F0 context. A corollary is that the phonetic conditions under

\[ ^{15} \text{ Although a recent paper by Esther Grabe et al. suggests in passing that the source of prehead pitch level in standard Dutch may be "a spreading operation of the first T* [in the intonational phrase]" (Grabe et al., 1997:76)} \]
which tone spread is allowed may vary in language-specific ways. For English, she formulates the rule that:

\[ T_i^- \text{ spreads towards } T_{i+1} \text{ if } / T_{i+1} / \geq / T_i^- / \]

This rule states that spreading of \( T^- \) (the trailing tone of a bitonal accent or an intermediate phrase boundary tone), occurs when the following tone is phonetically of equal or higher F0 value. In the following section I will examine whether this rule applies to Kuninjku.

5.5.2  **High sustained F0 in Kuninjku hat patterns**

In Kuninjku, there are three hat pattern contours in which a high F0 level is sustained following an initial accent peak, up to another accent peak.

The first is the plain ‘flat hat pattern’ contour (Figure 5.20). The alignment of accent-related peaks within the hat pattern is discussed in detail in section 5.4.5.1 above. In the following examples, the period of sustained high pitch is indicated with an arrow.

![Figure 5.20: Flat hat pattern in Kuninjku (the arrow indicates the period of postaccentual sustained high F0).](image)

Transcription: ka-kodj-djeyo
Gloss: 3-head-make.lieNP.
Translation: ‘he is sleeping’.

*Sound file 5.11*
In a contour such as this, in which both the first and second accents peak at approximately the same F0 height, the sustained high F0 on the postaccentual syllable could either be accounted for by phonetic interpolation between the two high targets (assuming, contra Pierrehumbert (1980), the possibility of monotonic interpolation between two high accentual tones), or by tone spread from the first accent. The two accounts are not distinguishable with reference to contours such as this.

However, a second pair of contours does allow us to distinguish the two accounts. The ‘raised peak’ hat pattern and the ‘downstepped peak’ hat pattern are two variants on the flat hat pattern which have been described in the literature (e.g Ladd 1983) (Figures 5.21 and 5.22). Both involve a local adjustment of the height of the second accent relative to the first, either up (the ‘raised peak’ hat pattern contour) or down (the ‘downstepped’ hat pattern contour).

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**Figure 5.21:** ‘Raised peak’ hat pattern in Kuninjku across kanh-kornmud-yirridjmeng Kuninjku (the arrow indicates the period of postaccentual sustained high F0).

Transcription: kan-h-kornmud-yirridjmeng ngarrewoneng
Gloss: 3/1pl-IMM-pubic.hair-tickleNP our
Translation: ‘he’s tickling our pubic hair’.

*Sound file 5.12*
Figure 5.22: ‘Downstepped’ hat pattern in Kuninjku across *bi-marne-wenjhmeng* (the arrow indicates the period of postaccentual sustained high F0).

Transcription: *bi-marne-wenjhmeng* kumekke
Gloss: 3P/3h-BEN-be.cunningPP LOC.DEM.
Translation: ‘He tricked him there/in relation to that’.

**Sound file 5.13**

<table>
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<th>!H*</th>
<th>Lp</th>
<th>!H*</th>
<th>Lp-%</th>
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<tbody>
<tr>
<td>words</td>
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<td>marne-</td>
<td>-wenjhmeng</td>
<td>kumekke</td>
<td></td>
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<tr>
<td>breaks</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

The three contours illustrated above are unified by the fact that the F0 level reached by the first accent is the level which is sustained up to the next tone specification. It is never the case that the level of the second accent extends back to the first (which would suggest a leftward spreading mechanism). The contours differ only in what follows the initial accent.

In the flat hat pattern, equal prominence relations between the two accents dictate that the second accent peak will have approximately the same F0 level as the preceding accent (though declination and anticipation of final lowering may lower the second accent slightly in relation to the first). Since no additional time is required to meet the second tone target, which has already been met at the onset of the second accented syllable because of the preceding high plateau, the instruction to fall to the baseline is immediately implemented and an ‘early peak accent’ occurs (see section 5.4.6.1).
In the raised peak and downstepped peak contours, the following accent has a local range modification applied to it, such that it is higher or lower in pitch than the initial accent. The F0 level of the first accent is nonetheless sustained up to the second accented syllable.

5.5.2.1 Tone spreading vs phonetic interpolation in flat hat, ‘raised peak’ and ‘downstepped peak’ hat patterns

The phonetic realisation of the flat hat pattern could be accounted for in terms of a phonetic interpolation model implementing a linear path between the two high peaks, since these are scaled at a similar height. However, the raised peak, downstepped peak and non-hat pattern contours described above create difficulties for a phonetic interpolation model.

In the context of a sequence of pitch accents in which the second accent peak is phonetically higher or lower than the preceding peak, the predictions of phonetic interpolation differ from tone spreading. A tone spreading account predicts that the high F0 level set by the preceding accent will be sustained up to the syllable bearing the locally raised or lowered H tone. In contrast, an optimally general phonetic interpolation rule would predict that the most direct path will be taken between the two targets, producing a gradually rising or falling transition. While it may be possible to modify the interpretation of phonetic interpolation such that it applies in a different manner to a sequence of H tones (as did Pierrehumbert (1980)), such a modification is undesirable insofar as it undermines the generality with which interpolation is phonetically interpreted.

The phonetic realisation of the raised peak and downstepped peak hat patterns in Kuninjku is as predicted by a tone spreading mechanism, not phonetic interpolation (Figures 5.23 and 5.25). Thus the two patterns shown in (a) and (b) in Figures 5.23 and 5.25 differ only in the phonetic realisation mechanism involved, and not in the number of tone targets.
Where * represents the location of accent, the phonetic realisation of the raised peak hat pattern is:

(a) and not (b)

Figure 5.23: Phonetic realisation of the raised peak hat pattern contour in Kuninjku

The fact that the second peak is ‘boosted’ in pitch relative to the first supports the analysis of two accentual H targets in the phonological representation of the hat pattern, since the scaling of the second H tone is distinct from the first. It is therefore necessary that the phonetic interpretation of each H tone be independent of the other. (This does not imply that the height of the second H tone in the phrase is entirely independent of the height of the first, however, since prominence relations may constrain the relative heights of each peak.)

Figure 5.24 gives a further example of a raised peak hat pattern contour in Kuninjku:

Figure 5.24: Raised peak hat pattern contour in Kuninjku (the arrow indicates the period of postaccentual sustained high F0).

Transcription: nga-re nga-mang
Gloss: 1-goNP 1-getNP.
Translation: ‘I’ll go and get it.’
The downstepped peak hat pattern is realised as a span of high F0 followed by a lowered high tone target (!H*), that is, as (a) and not as (b), where * represents the location of accent:

(a)  

(b)

Figure 5.25: Phonetic realisation of the downstepped peak hat pattern contour in Kuninjku

While a spreading analysis predicts the shape in (a), an interpolation analysis would incorrectly predict the shape in (b). Figure 5.26 (below) is a further illustration of a downstepped peak hat pattern contour in Kuninjku.

Incidentally, unlike the raised peak pattern, it is not clear that the downstepped peak hat pattern is necessarily to be interpreted in terms of a prominence relation between the initial and second accents based purely on accent height. In examples such as Figure 5.22 above (*bi-marne-wenjhmeng*), the second, downstepped accent is at least as auditorily prominent as the first (see Ladd et al., 1994 in relation to perceived prominence of adjacent accents of varying heights).
5.5.2.2 Postaccentual high tone preceding a low boundary

Further evidence in favour of a tone-spreading mechanism comes from contours in which high F0 is sustained across the immediate postaccentual syllable, even though the next tone target following the accent is low. In these examples, the ‘phonetic interpolation’ mechanism clearly cannot be applied in any simple manner to explain the perseverance of high pitch following the accentual peak, since phonetic interpolation predicts a linear fall from the high accent peak directly to the following low target.

In Figures 5.27 to 5.29, the F0 level of the initial accent is maintained at the F0 height set by the initial accent, across the immediate postaccentual syllable. This postaccentual high F0 is represented by the label =>. A rapid drop to the low tone target follows.
Figure 5.27: High pitch sustained across the accented foot *kondah*, ‘here’ (the arrow indicates the period of postaccentual sustained high F0).

Transcription: kondah ngarn-di
Gloss: here ?-standNP

Sound file 5.16

Figure 5.28: Example of high pitch sustained across the accented foot *bene-* in *bene-bom* (the arrow indicates the period of postaccentual sustained high F0).

Transcription: bene-bom bene-yakwong
Gloss: 3ua-hitPP 3ua-finishPP
Translation: ‘The two of them hit it and finished it off’.

Sound file 5.17
In Figure 5.29, the high tone spreads to the end of the first postaccentual syllable, rather than the end of the initial foot or the word: the syllables *ben-dah* do not constitute either a foot or a word.

Figures 5.30 and 5.31 form a near-minimal pair in relation to postaccentual sustained high F0. In Figure 5.30, the accentual H* tone on the syllable *beb* of *kam-behme* gives way to a low tone on the final syllable of the word. By contrast, in Figure 5.31, though there is no obvious contextual reason for the pitch to remain sustained on the final syllable of the foot, it does so, rather than falling directly to low as in Figure 5.30. It is not yet clear what, if any, meaning might be attached to this kind of variation. However, impressionistically, the two verbs in the second example seem
more closely linked because of the high tone at the end of the first verb (the following two encliticised connectives, \(la\) (‘and’) and \(wanjh\) (‘then’) carry the boundary low tone).

Figure 5.30: Fall through the accented syllable \(beb\) in \(kambebmeng\): no postaccentual high F0.

Transcription: ka-m-bebmeng
Gloss: 3-hither-appearPP 3-hither-goPP close.by
Translation: ‘He appeared and came close by.’

Sound file 5.19
Figure 5.31: Postaccentual high F0 on the final, unaccented syllable me in kam-bebmeng (the arrow indicates the period of postaccentual sustained high F0).

Transcription: ka-m-bebmeng la=wanjh bene-kurrmerrinj
Gloss: 3-hither-appearPP and=then 3ua-put-RR-PP.
Translation: ‘He appeared and then the two of them put themselves (into a hollow in the ground(?)).’

Sound file 5.20

In Figure 5.31, there is a rapid fall to a lower level at the very edge of the syllable me. This fall is not audible as such, due to its rapidity and occurrence at the right periphery of the syllable (cf. House, 1990, who demonstrates that the coding of pitch level across a syllable (High or Low) depends on the pitch level early in the syllable, generally soon after the vowel onset).

To summarise, although the interpolation mechanism could account for sustained high pitch in the ordinary flat hat pattern, a tone-spreading account is better able to produce a unified account of post-accentual high pitch in the two circumstances described above: in hat pattern contours, where the initial accent is followed by sustained F0 up to the onset of another accent gesture; and in a certain set of non-hat pattern contours, in which the accent is followed by high sustained F0 only on the postaccentual syllable, before a low boundary.
By most current definitions, a single accentual tone is ‘punctual’: it associates to a single syllabic peak, and generally renders the accented syllable distinct in pitch level from the surrounding unaccented syllables. As an assumed universal, however, this definition of the scope of accent may be too constrained. For example, in English, the main culminative role of an accent is to distinguish accented from unaccented words. Important distinctions related to information structure are based on this primary, post-lexical role of accent. The secondary culminative role of accent is to distinguish accented from unaccented feet within a word. This role is ‘secondary’ since distinctions in the interpretation of the phrase do not ride upon it. For example, recent research on the multiple accenting of words in English (Shattuck-Hufnagel, Ostendorf and Ross, 1994) suggests that additional accents in a word are frequently a function of structural or rhythmic prosodic requirements, such as phrase-onset marking or rhythmic alternation.

If we consider the role of the accent at the next level down in the prosodic hierarchy, the syllable, it is clear that whether an accent peaks on the first or the second syllable in a polysyllabic foot, or is marked by high pitch and high amplitude across both, no further information is provided about the culminative function of the accent than if high pitch consistently peaked on the metrically strong syllable alone (though other distinctions in meaning may be associated with such differences in accent shape or extent). This suggests that the culminative function of the accent effectively operates at the level of the foot and not, as is often assumed, the syllable that is its head. In relation to Kuninjku, this suggests that postaccentual high tone spread from the accent is not problematic for the culminativity of the accent within the foot.

5.5.2.3 The representation and distribution of postaccentual high tone spreading
The issue remains of how to account for when postaccentual high tone spreading applies and when it does not. This issue has implications for the representation of the spreading. There are (at least) two possible ways of representing high post-accentual tone spreading. The first is by a separate choice of accent, as postulated in
Pierrehumbert (1980): H*(+H−). The second is by a ‘surface modification’ of an underlying H* accent, transcribed H*=>.

The status of ‘surface modification’ has already been proposed for the late peak accent, H*<, in section 5.4.8.3 above. In some cases, e.g. in disyllabic morphemes initial in an intonational phrase, late peak may be minimally distinguished from postaccentual high tone spreading by the location of the peak (in the post-stress syllable in H*<, in the stressed syllable in H*=>). In other situations, however, such as at the end of the word kam-bebme in Figure 5.31, the only possible transcription is H* with postaccentual spreading, since the accent affected is neither initial in the utterance nor upstepped.

The first representational option for postaccentual tone spreading, namely, the addition of an accent H*+H− to the intonational inventory, would remove the ‘issue’ of the stipulation against the spreading of accentual tones. This is not a strong motivation, however, since that stipulation itself seems poorly motivated. H*+H− has been discarded by Pierrehumbert herself (cf. Beckman and Pierrehumbert 1986: note 2, p.306; Ladd 1996: 274-276), partly on the basis that it alone would violate the Obligatory Contour Principle among the accents of English.

The fact that the representation H*+H− involves the addition of a tone to the underlying representation, the trailing (+)H− tone, would, if it were used to annotate postaccentual high F0, imply that an H* accent with postaccentual tone spread has a different phonological status from the late peak accent H*<. However, there is presently no motivation for assigning such a difference in phonological status to the late peak accent and accents with high tone spread to the postaccentual syllable. On the contrary, both the late peak accents and those with high tone spread share the property of being neither clearly phonologically distinct nor phonetically conditioned. This leaves two possibilities: the patterns are simple random variation in phonetic realisation; or they are pragmatically conditioned surface phonological modifications, for which the relevant pragmatic conditions are not entirely evident as yet.

In the case of the late peak accent, I have suggested a possible utterance-onset marking role for the modification. Insofar as onset-marking involves drawing the
hearer’s attention to a juncture, and attentional or information-packaging phenomena fall within the scope of pragmatics, this demarcative role may be labelled pragmatic. In the case of postaccentual high tone spread, my impression is that the increased duration of the high tone lends a greater sense of coherence with what follows. Although the intuitions of a non-native speaker must carry little weight, on the basis of this impression I would hypothesise that postaccentual high tone spread is also a surface modification of an underlying high pitch accent, which I will designate H* =>. 

5.5.3  *Adjacent H tones in hat patterns and the Obligatory Contour Principle (OCP)*

Goldsmith (1990: 309) formulates the OCP as “a principle (or rather, a family of closely related principles) that prohibits consecutive or adjacent identical segments” in autosegmental tiers. He suggests that the OCP may not hold in its strongest form in accentual languages such as English, which has

...words that seem like they have a HHL tone pattern – ...for example, in the neutral pronunciation of a word such as *linguistics*, or any word with the same stress pattern (1990: 310) [emphasis in original text]

A monomorphemic word in English (and many other stress accent languages) may indeed carry two H* accents, and in the case of the flat hat pattern, there would seem little doubt that both H tones are adjacent on the tone tier. Though it might be argued by some that the accents are underlingly separated by an L tone (such as the trailing tone of an H*L accent), if the L-deletion process required to produce the hat pattern is considered to be a phonological process, an intermediate phonological representation H* … H* would still be posited (as it is in Grabe, 1998: 20), and thus, a violation of the OCP would still be recorded.

In Kuninjku flat hat pattern contours, the second H accented syllable merges phonetically with the preceding tone level, *unless* it is specified as raised (increasing its prominence relative to the initial accent) or downstepped. In the flat hat pattern, the initial and final accented syllables may not differ much in prominence either from each other, or indeed from the intervening high-pitched syllables. In this case, the phonetic evidence for two separate underlying H accents may not be strong. However,
as discussed in section 5.5.2.1 above, the raised and downstepped peak hat patterns, in which the second high tone is phonetically ‘boosted’ or ‘lowered’ in F0 height relative to the first, do clearly provide evidence for two underlying H accents, contra the OCP prohibition. In both cases an underlying second H target must be present for these F0 adjustments to be interpreted upon.

5.6 Conclusion

In the second half of this chapter, I have argued that a mechanism of high tone spreading from an accentual (H*) tone is needed in order to account for two patterns of high sustained tone following an initial H* accent. One pattern involves sustained high F0 between two H* accents, of which the second accent may be upstepped (^H*) or downstepped (!H*), the other, high sustained F0 on the immediate postaccentual syllable, preceding a low boundary. In each case, the F0 is sustained at the level of the preceding H* accent target.

I demonstrated that neither the phonetic realisation of the raised peak/downstepped peak hat patterns nor the pattern in which the high tone of an accent spreads to the postaccentual syllable can be accounted for in terms of phonetic interpolation. A mechanism of phonetic interpolation is, however, needed to account for the more common pattern in Kuninjku in which the F0 falls directly from the phrase-final high accent target to the following low boundary tone target: refer to the final fall in Figures 5.24 (after the accent in nga-mang) and 5.29 (after the accent on djerrh), for example. For this reason, I hypothesise that the high sustained postaccentual F0 is a surface phonological modification of the H* tone, similar to the late peak modification (H*<).

In this chapter I have shown that the nature of the phonetic interpretation mechanisms used in a given language needs to be specified as part of the process of intonational labelling: different mechanisms (such as phonetic interpolation and tone spreading) make different predictions about the surface F0 patterns which occur. There is a certain conventionality to these interpretation mechanisms: while Kuninjku spreads an initial high accent target, with its scaling intact, up to a following high accent target,
another language might directly interpolate between two differently scaled high tones. Languages may combine more than one mechanism: a combination of phonetic interpolation and tone spreading mechanisms are needed to account for the F0 contours which are observed in Kuninjku.
Chapter 6

The low phonological phrase boundary tone and other correlates of prosodic constituency

6.1 Introduction and overview

In Chapters 3 and 5, I addressed issues relating to the nature of intonational pitch accents in the Kuninjku and Manyallaluk Mayali dialects, namely, how pitch accents are assigned, what factors influence their scaling and alignment, and how the phonetic implementation of tonal transitions between accents, and between accents and boundary tones, might be modelled.

In this chapter I will examine evidence for prosodic constituency and in particular, evidence for the phonological phrase (PhonP) in the Kuninjku dialect. This evidence will be principally derived from data on tone scaling and alignment.

The central argument of this chapter is that falling intonational boundaries in Kuninjku are due to the presence of a low phonological phrase-level boundary tone, denoted Lₚ. I will argue that the phonological phrase low boundary tone is the single phonological source of low boundaries at three prosodic constituent levels, the phonological phrase, the intonation phrase (IP) and the utterance. Other evidence for distinguishing these levels of prosodic constituency includes relative prominence relations between accents, and segmental lengthening as a correlate of prosodic boundary strength. The latter issue was raised incidentally in Chapter 3 in relation to the phonetic correlates of accent.

The outline of the chapter is as follows. In section 6.2, I provide a brief overview of the literature on phonological phrasing in analytic languages such as English, in which complex syntactic relations are contracted between words (section 6.2.1). This literature is largely oriented toward syntax as the primary, if partial, determinant of phonological phrasing, which raises questions as to what determines phonological phrasing in a language such as BGW, in which there is little overt evidence for syntactic relations between morphosyntactic words (Evans, in press: §13.1). In section 6.2.2, I outline evidence for the phonological phrase proposed in
two studies of other polysynthetic languages, Cayuga (Dyck, 2001) and Lushootseed (Beck, 1999).

In section 6.3, I present prosodic evidence for a phonological phrase level constituent in Kuninjku. The principal direct evidence for this level is the presence of a low tone at the right boundary of the phrase. I will exclude a possible alternative analysis of the low tone as the trailing tone of a preceding high pitch accent.

In sections 6.4 and 6.5, I provide phonetic evidence for the distinctiveness of the three prosodic constituent levels, the phonological phrase, the IP and the utterance. Section 6.4 presents an experiment on the scaling and alignment of the low boundary tone in phonological phrase-final, IP-final, and utterance-final positions. In section 6.5, I present statistical findings on vowel durations in word-final feet in these positions.

In section 6.6, I examine the scaling of the $L_p$ tone in relation to the scaling of the preceding $H^*$ accent peak. This experimental data suggests that a distinct tonal register is defined within each phonological phrase, providing further support for the phonological phrase as a prosodic constituent in Kuninjku.

In section 6.7, I analyse the phonological structure of the $L_p$ boundary tone in Kuninjku, and locate the tone with respect to the typology of boundary tones described in the autosegmental-metrical literature to date.

Section 6.8 concludes the chapter.

6.2 Literature on the phonological phrase

6.2.1 The phonological phrase in non-polysynthetic languages

Most of the literature on the phonological phrase comprises one or both of two principal lines of enquiry. The first relates to the phonological effects of the phrase. These include effects on segmental and pause durations (e.g. Gee and Grosjean, 1983), the distribution of tones (e.g. Hale and Selkirk, 1987; Hayes and Lahiri, 1991; Dyck, 2001), and relative prominence relations (Nespor and Vogel, 1986; Hayes and Lahiri, 1991). The second line of enquiry relates to the actual determinants of phonological phrasing. Most of the literature on the determinants of phonological phrasing investigates languages with limited morphological agglutination, and is couched in X-bar (or Government and Binding) theory (Jackendoff, 1977; Chomsky, 1981), which describes the formation of syntactic constituents through the projection.
of lexical category information (cf. Gee and Grosjean, 1983 on English; Hayes and Lahiri, 1991 on Bengali; Hale and Selkirk, 1987 on Papago; Nespor and Vogel, 1986 on English and Northern Italian). Even in analyses which take account of purely prosodic factors affecting phonological phrasing, such as rate of speech or the length of constituents (e.g. Gee and Grosjean, 1983), or in which the phonological phrase level is primarily defined by its conditioning of phonological alternations and the distribution of tones (e.g. Jun, 1996), phonological phrasing is still considered to be constrained by an underlying relation to syntactic headedness or constituency1 (Selkirk, 1986; Jun, 1996: Chapter 5).

There are two basic aspects to phonological phrasing as described in X-bar theory: a correspondence between the location of a lexical category head (typically a noun (N), verb (V), adjective (A) or preposition (P)) and the location of the left or right edge of the phonological phrase; and the direction in which the remaining lexical material (content words acting as modifiers and function words) is gathered up into phrases with the head. The direction in which words are gathered up generally depends largely on the direction of branching of the syntax.

Gee and Grosjean provide the following basic description of the formation of phonological phrases in English (1983: 432-3):

The head is the main word around which the phrase is organized (the category from which the phrase is projected, in linguistic terminology). […] A φ-phrase [phonological phrase – JB] is designed simply as follows: In any syntactic phrase, all the material up to and including the head is a φ-phrase.

They qualify this description in relation to the behaviour of Prepositional Phrases (PPs) and function words, which do not behave as the heads of phonological phrases in English (1983: 434):

Prepositions are the heads of PPs (they are the category about which the phrase is organized), but they are also (most of them) function words. As stressless function words they lose their word status prosodically, and so cannot serve as heads any longer. In particular, they cannot terminate φ-phrases (since heads terminate φ-phrases). Rather, they make up φ-phrases with the material up to and including the next head “down the line”, namely the head of the NP that serves as a complement to (that follows) the preposition.

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1 Often this relation is defined in a manner quite specific to the language in question: e.g. the syntactic head must be governed or not governed in a certain manner (Hale and Selkirk, 1987), or an argument and not an adjunct (Chen, 1987).
This behaviour of PPs is one illustration of the often-observed fact that lexical category and subcategorisation information is quite frequently relevant to prosodic behaviour (Gee and Grosjean, 1983: 449-450; Pynte and Prieur, 1996: 168; also Nespor and Vogel, 1986:169).

Gee and Grosjean (1983) refer to two kinds of phonological evidence for phonological phrases. The first is segmental alternations of the kind discussed by Nespor and Vogel (1986), which make reference to a unit the size of the phonological phrase. Such segmental rules are either blocked, or apply, at the boundaries of phonological phrases. The other evidence they describe is from inter-phrase pause durations. This evidence is phonetic, statistical and probabilistic in nature. Gee and Grosjean claim that a unit the size of the phonological phrase is required in order to describe the hierarchical and syntagmatic structure of pausing behaviour within any given utterance.

Interestingly, Gee and Grosjean (1983) suggest that the kinds of lexical material which are grouped into phonological phrases in English are kinds that tend to be closely morphosyntactically integrated in more synthetic languages (1983: 455):

φ-phrases are of three basic sorts: (a) determiners, articles, and such grammatical words, plus modifiers, plus a phrasal head (e.g., “the #young woman”) - a tightly bound package of conceptual information that might well be lexicalized as a single lexical item in another language; (b) subject and/or object pronouns plus auxiliary verbs, plus the main verb (e.g., “will#have#been#reading#it”) - material that many languages express as a single morphologically complex word via the use of enclitics and/or affixes; (c) and, finally, prepositions plus their complements (e.g., “in#the#house”) - material that in case languages is expressed as a single word, i.e., noun + case marker, as in Latin “puellae”, “to the girl”. Thus, the φ-phrase may be a prosodic analog of material that functions on-line much like “big words” (perhaps, the φ-phrase is necessitated by the highly analytic character of English - research on morphologically complex languages is crucially need in psycholinguistics, here and elsewhere).

Gee and Grosjean’s analogy of phonological phrases to “big words” predicts a fairly isomorphic relationship will be found between morphosyntactic units and phonological phrases in highly synthetic languages.

Nespor and Vogel (1986) examine the phonological phrase level across a small set of European languages. Unlike Gee and Grosjean, they discuss its culminative, as well as its demarcative or edge-related, phonological properties. They propose that the phonological phrase constitutes a level of metrical (rhythmic) constituency, such that there is one strong prominence per phonological phrase. The relative strength of this prominence is partly indicated by the stability of its location:
within the same phonological phrase, a lesser prominence may be retracted to a location earlier in the phrase, as an effect of ‘prominence clash’, but the ‘primary’ prominence will not change position. Nespor and Vogel (1986) claim that such retraction would not occur if the two prominences were separated by a phonological phrase boundary.²

Nespor and Vogel also claim that crosslinguistically, the word which is the syntactic head in the phonological phrase constitutes the most metrically prominent element of the phrase (Nespor and Vogel 1986; Nespor 1999). They do not make any claims regarding the phonetic exponence of thismetrical strength (such as pitch accent), though it is referred to as a constraint on “relative prominence” within the phrase (Nespor 1999: 121). The correspondence Nespor and Vogel posit between syntactic and metrical headedness in the phonological phrase in languages including English, Greek, Turkish, Dutch and German is not universal, however. It does not hold in Bengali, for instance. In Bengali, the rightmost word is the lexical head, and determines the location of the phonological phrase edge tone $H_p$. However, the Bengali ‘P-phrase stress’ rule requires that “the leftmost non-clitic word is the strongest [prominence]” in the phrase (Hayes and Lahiri, 1991: 55).

In the following section, I will review evidence for the phonological phrase in polysynthetic languages.

6.2.2 The phonological phrase in polysynthetic languages

6.2.2.1 Intonational and prosodic constituency in polysynthetic languages

Very little research has been carried out on levels of prosodic constituency in polysynthetic languages, and specifically, on the existence or otherwise of a level of prosodic phrasing between the intonation phrase and the phonological word. It is possible that such research could shed light on the syntactic and semantic organisation of polysynthetic languages, given the close relationship between syntactic headedness and constituency and phonological phrasing claimed for so many non-polysynthetic languages (cf. Inkelas and Zec, 1990).

Taff et al. (2001) examine intonation in elicited sentences (declarative and interrogative) in Eastern Aleut. Eastern Aleut is a member of the same language family as West Greenlandic Eskimo – Eskimo-Aleut – and, as is characteristic of this

² However, in a later account, Nespor and Vogel reformulate the rule of stress retraction purely in terms of the
family, is an almost entirely suffixing language (Katzner, 1995). Taff et al.’s findings lead them to the tentative conclusion that “word-level information chunks are identified intonationally by a particular pitch contour”. Apparently similar to an HL word contour observed in West Greenlandic Eskimo (Nagano-Madsen and Bredvad-Jensen, 1995), this contour typically takes the form of “pitch peaks near word beginnings and troughs near word ends” (2001: 261-2). As is typical of polysynthetic languages in general, the inflected (verbal) content word in Eastern Aleut has the potential to form a complete sentence. The authors speculate that

[I]f a word-sized domain does function as an intonational domain it may be related to the morphological structure of Aleut. Perhaps each word is treated intonationally as an individual phrase within the sentence because it must have inflectional suffixes and may have numerous derivational suffixes which provide it the potential for standing alone as a sentence.

Taff et al. do not discuss the intonation of ‘function words’, and whether or not these integrate into intonation units with content words. Nor is the question of prosodic constituency explicitly addressed – such as the phonological status of higher levels of intonational constituency. However, they do observe a pattern of declination across word-level contours which might relate to such a level (2001: 262):

These linked word contours are affected by downtrends to form a cascade effect in which each successive peak and each successive trough is slightly lowered from the beginning to the end of each sentence.

Taff et al. also cite a study of Cup’ik (Central Alaskan Yupik Eskimo), a language “geographically proximate to and distantly relate to Aleut”, by Woodbury (1993). Woodbury found that “content words have characteristic contours… but in Cup’ik such words begin with troughs and end with peaks” (cited in Taff et al., 2001: 262).

6.2.2.2 Phonological phrasing in Cayuga
Dyck (2001) argues for the existence of a ‘prosodic phrase’ (φ) constituent in Cayuga, a polysynthetic language spoken in upstate New York. The constituent level in the prosodic hierarchy Dyck is referring to – the postlexical level directly above the phonological word – is the level I am calling the phonological phrase (see section

6.3). Dyck does not, however, seek to distinguish the prosodic phrase from potential higher level phrases, such as the intonation phrase.

Dyck’s analysis of the distribution of prosodic phrase boundaries is loosely couched in terms of X-bar theory, as extended to polysynthetic languages by Baker (1988)\(^3\). The verbal word in Cayuga, which can incorporate a nominal word, always forms a prosodic phrase. The pronominal subject prefix forms a prosodic word together with a preceding morphological marker of mood, which in turn maps to a single prosodic phrase together with the verb stem:

…assuming that the left edges of X\(^0\)s [morphemes belonging to a single lexical category -JB] and XPs [syntactic phrases projected from the lexical category] are mapped to prosodic edges in Cayuga, even simple verbs… will contain at least two prosodic words.

Independent nouns in Cayuga are prosodic words and often, but not always, single prosodic phrases. Particles generally phrase together with a preceding or following noun or verb (Dyck, 2001: 5-7). The phrasing algorithm Dyck provides (see below) would seem to suggest the possibility of recursively embedded prosodic phrasing (of XPs within the larger IP [=Inflectional Phrase]). However, Dyck does not address this issue.

- The left edge of X\(^0\) is a prosodic word (ω)
- The left edge of XP is a prosodic phrase (φ)
- IPs map into prosodic phrases

(adapted from Dyck, 2001: 1)

Prosodic evidence for the prosodic phrase in Dyck’s analysis comes from the distribution of an H tone, which is located at the right edge of phrases as determined by the syntactic algorithm described in the quotation above (2001:7). Dyck refers to this H tone as a “pitch accent”:

Pitch accent does not consistently fall near the edge of any particular word. However, it does appear to occur near the edges of phrases if citation forms are analysed as phrases. Pitch accent therefore appears to mark phrase edges more than word edges.

It is not clear from Dyck’s analysis whether the prosodic phrase as diagnosed by the presence of the H tone, on the one hand, and as determined by the syntax, on the other, always coincide in Cayuga.

\(^3\) For a discussion of problems in the application of this framework to BGW, see Evans (in press).
Dyck’s tonal analysis is somewhat ad-hoc, which makes interpretation of the tonal information she supplies a little difficult. She claims at different points in the analysis that a high “pitch accent” and “H%” (described as a “continuation-rise boundary tone”) occur prosodic phrase-finally. Her analysis implies that in the case where H% is present, there is no pitch accent present. However, there is another observed contour, a fall, which is designated H*L%. It appears from Dyck’s discussion that she considers the H tone in each case to be the marker of the phonological phrase edge, but that, where an L% boundary tone follows, the H tone will associate not to the phrase edge per se (as H%), but to a preceding metrically strong syllable. The difference in association is explained by invoking “a constraint against contour tones on the same vowel”:

The examples… illustrate that the boundary H% [of the continuation-rise contour - JB] associates to the last vowel of any word which happens to be phrase-final. In contrast…[when] a L boundary tone associates to the final syllable of the phrase [in the falling intonation contour], … a H nuclear tone associates to the nearest metrical prominence (marked with an acute accent) to the left of the L boundary tone, and… the H can even spread leftwards. (I assume a constraint on contour tones on the same vowel.) (Dyck, 2001: 9)

These observations may be amenable to reanalysis in a more consistent framework. Dyck claims that an H tone – either an accent or a boundary tone – demarcates the edge of a prosodic phrase. However, in the two sample sentences she presents as simply ending in H%, the phrase-final syllable is marked as metrically strong. I would suggest that the proper analysis of these phrase edges may be H*H%, with the two H tones merging phonetically to a single H target. This would enable an analysis of the H* pitch accent as the culminative cue to the prosodic phrase in all contexts, followed by a boundary tone (either H% or L%), possibly associated with the next highest level of constituency, such as the intonation phrase. By virtue of its peripheral, rightmost position in the phrase, the H* pitch accent would serve as an index of the edge of the prosodic phrase.

6.2.2.3 Phonological phrasing in Lushootseed

In the polysynthetic Salishan language Lushootseed (Beck, 1999), a phonological word (W) groups together with a single preceding clitic (C) to form a phonological phrase. Lexical class is the basic determinant of phonological wordhood in Beck’s analysis: thus members of the major lexical classes (noun, verb) typically form the
core of a phonological phrase in Lushootseed. This is in accord with Selkirk (1986), for whom the left or right edge of the prosodic or phonological word maps to the left or right edge of the major lexical class lexemes \(X_0\).

Words belonging to predicative and potentially predicative lexical classes other than nominals and verbs, such as adverbial words (1999:38-39), tend to be variable in their phrasing: “the clitic/word status of these elements depends not on whether the adverb functions as a syntactic predicate, but on which phonological realisation, C or W, is needed to best preserve the ideal (CW) phrasal template.” (1999:39) Beck (1999: 38) remarks that

\[\text{[a]s in other Salishan languages, Lushootseed words are often divided into predicative and non-predicative classes... and to a certain extent this division is reflected in the [phrasal] phonology [...] In the phonology, the rule of thumb is that predicative words act as phrasal heads (i.e. are words) while the others adjoin either rightward or leftward to full words within the phrase boundary.}\]

Non-predicative words include pronominals, prepositions and interjections (1999:38). Deictic markers (such as demonstratives), although potentially predicative and definable as syntactic heads (Beck (1997; 1999: 38)), also behave as clitics. Beck provides the following example of a demonstrative (ti?i?) behaving as a clitic to a nominal word, with which it forms a single phonological phrase (1999:38):

\[
(C\quad C+W)
\]

\[
(ti?i\hat{\nu} ti + s?úladx\hat{w})
\]

\[
D\quad D+salmon
\]

‘a salmon [was] this one’

In this example, one of the demonstrative ‘clitics’ is an affix (ti) rather than a full clitic; full clitics and affixes are distinguished “in that where ordinary clitics generally retain their own shape and original segmental material, an incorporated clitic resyllabifies with a stem, and in most cases, either loses a mora or some phonemic material…” (Beck, 1999:30).

Prosodically, the phonological phrase in Lushootseed forms the domain of a culminative prominence, a “unique phrasal stress as marked by amplitude and usually, vowel length (Barthmaier, 1998)”.

335
6.3 Evidence for the phonological phrase in Kuninjku

In this section, I describe the qualitative prosodic evidence for the phonological phrase constituent in Kuninjku. Kanerva (1990: 160) proposes that a “level in Prosodic Phonology may be identified by its relative position in the prosodic hierarchy, by a level-specific cluster of phonological properties, and by its principles of construction”. I will address the first two diagnostics in this section, and the last, in an informal manner, in Chapter 7.

The principal direct evidence for the phonological phrase constituent in Kuninjku comes from the distribution of a low tone, denoted $L_p$ (section 6.3.1). Other evidence comes from accent assignment patterns which distinguish the phonological word from the phonological phrase (section 6.3.2), and relative prominence relations contracted between phonological phrases (section 6.3.4). In section 6.3.3, I demonstrate that a possible alternative analysis of the low tone, namely, as the trailing tone of a preceding high pitch accent, is not supported by the data. Later in the chapter (section 6.7), I will present evidence suggesting that the phonological phrase serves as a distinct phonetic domain for accent and boundary tone scaling.

6.3.1 Distribution of the low tone ($L_p$)

In Kuninjku, a low tone frequently aligns with the final or penultimate syllable of an accented phonological word. Figure 6.1 illustrates the distribution of the low tone in relation to the right edge of phonological words. The words followed by a break index juncture of “1” are intonation-phrase medial; they include a verbal word (yin-nguneng), a demonstrative (kun-mekke) and a nominal word (na-djamun).

As mentioned above, there is evidence that this low tone is actually phonologically associated with a prosodic constituent above the level of the phonological word. Such evidence comes from utterances in which (generally not more than two) accented phonological words precede the low tone, thus forming a single prosodic constituent bounded by a single low tone at its right edge\(^4\) (see Figure 6.2, below, and further illustrations in Chapter 7).

\(^{4}\) This argument assumes that the levels of the prosodic hierarchy in this language are not recursively embedded.
Figure 6.1: Alignment of low boundary tones with the final syllables of the accented phonological words yi-nguneng ‘you ate’, kun-mekke ‘that (food)’ (also an IP boundary), na-djamun, ‘(thing that is ) taboo’, and a second token of yi-nguneng. Nakka ‘that’, which modifies na-djamun, is unaccented. The arrows indicate the location of the low boundary tone targets.

Transcription: wanjh yi-nguneng kun-mekke na-djamun nakka yi-nguneng
Gloss: then 2/3-eatPP NEU-ANA.IMM. I-taboo MA.DEM. 2/3-eatPP
Translation: ‘Then you ate it, you ate that taboo (food).’

Sound file 6.1

<table>
<thead>
<tr>
<th>H*&lt;</th>
<th>Lp</th>
<th>!H*</th>
<th>Lp</th>
<th>%H*</th>
<th>Lp</th>
<th>!H*</th>
<th>Lp</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>wanjh yi-nguneng kun-mekke na-djamun nakka yi-nguneng</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5 The grouping of unaccented nakka with either na-djamun or the following yi-nguneng is tonally and auditorily ambiguous. However, Evans (in press: §7.3.2.1) observes that the demonstrative nakka ‘is almost always used pronominally rather than adnominally’, favouring an interpretation in which nakka is an adjunct to yi-nguneng, rather than forming a demonstrative phrase with na-djamun.
A single phonological phrase, integrating two phonological words\textsuperscript{6}. Accents are assigned to both the initial and final feet of the second phonological word in the phrase. An arrow shows the location of the single low tone; there is no low tone following \textit{ngudda=wanjh}.

Transcription: \textit{ngudda=wanjh ngune-bo-rro}  
Gloss: \textit{you=then 2ua-liquid.strikeIMPER}. 
Translation: ‘And you two, you hit the water (with your hands)’.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{sound_file_6.2.png}
\caption{A single phonological phrase, integrating two phonological words\textsuperscript{6}. Accents are assigned to both the initial and final feet of the second phonological word in the phrase. An arrow shows the location of the single low tone; there is no low tone following \textit{ngudda=wanjh}.}
\end{figure}

\textbf{Sound file 6.2}

\begin{tabular}{|c|c|c|c|}
\hline
\textit{ngudda=(w)anjh ngune-bo-rro} & \hline
\end{tabular}

\textbf{6.3.2 Accent assignment patterns in two-word phonological phrases}

When two phonological words form a single phonological phrase, the accent pattern of each phonological word is retained. This is another source of evidence for the distinctness of the phonological phrase and phonological word levels within the prosodic constituent hierarchy. A default single accent falls on the initial foot of a second phonological word within a phonological phrase, just as when the word on its own forms a single phonological phrase (see Chapter 3, section 3.11). That is, accents are not distributed only to the first foot of the first word in the phonological phrase and the final foot of the second. This is particularly evident when the initial accent on the second word is upstepped, as in the utterance \textit{ngudda=wanjh ngune-bo-rro},

\textsuperscript{6} As described in Chapters 2 and 3, there is a close correspondence between the morphosyntactic word and the phonological word in Kuninjku. I analyse processes of encliticisation and procliticisation (generally of discourse markers, such as \textit{wanjh}, and other connectives, such as the word for ‘and’, \textit{la}, as forming an enlarged
illustrated in Figure 6.2. If accents were actually assigned within the phonological phrase, rather than the phonological word, a phrase-initial and a phrase-final accent (only) would be the expected distribution of accents in phonological phrases containing more than one phonological word.

### 6.3.3 Rejection of the trailing tone hypothesis

The consistent co-occurrence of a high pitch accent with the low tone denoted $L_p$ might suggest an alternative analysis of the low tone, as a trailing tone associated with the preceding pitch accent – i.e., as the $L$ tone in an $H^*+L$ accent.

In autosegmental-metrical terms, after Pierrehumbert (1980), a bitonal accent is principally defined by the temporal proximity of two tones, one of which associates (and generally aligns) with a metrically strong syllable, the other with an adjacent syllable (although, in order to maintain consistency in the treatment of downstep, Pierrehumbert (1980) proposes that the $L$ tone of the $H^*+L$ accent in English does not surface as an actual tone target in the contour).

Primary evidence against the bitonal accent hypothesis in relation to Kuninjku comes from the temporal distance which is possible between the low tone and the preceding high accent-related tone. The high pitch accent may precede the low tone by as much as three or four syllables, and in each case, the low tone aligns in the same manner with the penultimate or the final syllable of the word. If the $L$ tone constituted the trailing tone of a bitonal accent, the $L$ tone target could be expected to align earlier in the word when the $H^*$ accented syllable was located at a further distance from the word edge. The $L$ tone target would need to occur earlier in order to maintain its proximity to the starred tone of the accent. Clearly this is not the case, as Figures 6.3 and 6.4 illustrate. The $L_p$ tone in each case aligns in proximity to the word edge, which is also the edge of the phonological phrase. Nonetheless, it appears that at least one accent is required within each phonological phrase, as its ‘head’. There are no phonological phrases in which an $L_p$ tone is present without a preceding high pitch accent within the phrase.

In the following figures, the phonetic alignment of the $L_p$ tone target is indicated by an ‘$L$’ in the ‘phon_tone’ (phonetic tone) tier. The phonological association of the tone is as indicated in the boxed transcription beneath each figure.
Figure 6.3: \( H^*< \) (late peak) pitch accent at a distance of three unaccented syllables from the edge of the word *bene-dapkeng*, with the L tone realised at the left edge of the final syllable (see Figure 6.4 for gloss and translation).

Sound file 6.3

\[
\begin{align*}
H^*< & \quad L_p & !H^* & \quad L_p-\% \\
\text{bene-dapkeng} & \quad \text{kumekke}
\end{align*}
\]

Figure 6.4: \( H^*< \) (late peak) pitch accent at a distance of four unaccented syllables from the edge of the word *wirriwirriyak*, with the L tone realised at the right edge of the final syllable.

Transcription: wirriwirriyak nuye darrkid
Gloss: black.faced.cuckoo.shrike he.OBL alive.
Translation: ‘Black-faced Cuckoo-shrike’s wife was alive.’

Sound file 6.4

\[
\begin{align*}
H^*< & \quad L_p & !H^* & \quad L_p & !H^* & \quad L_p-\% \\
wirriwirriyak & \quad \text{nuye} & \quad \text{darrkid}
\end{align*}
\]
6.3.4 Relative prominence relations between phonological phrases

In order to define a level in the prosodic hierarchy, one needs to distinguish the putative level from both the level below and the level above. I have shown that the level of the prosodic constituent in question is above the level of the phonological word. The principal source of evidence that the level of constituent demarcated by Lp is below the next highest level in the conventional prosodic hierarchy\(^7\) – the intonation phrase – comes from relative prominence relations between phrases, defined within the intonation phrase constituent.

Figure 6.1 showed two intonation phrases\(^8\) within a single utterance, *wanjh=yi-nguneng kun-mekke*, and *na-djamun nakka yi-nguneng*. In each of these two phrases, the first word ends in a low tone, followed by a word-level degree of perceived juncture (BI1). That is, each word constitutes a separate phonological phrase. In each of the intonation phrases, the accent on the last word is downstepped in relation to the first.

Figure 6.5 illustrates a relationship of downstep between the accents on *bene-dapkeng*, ‘the two of them crowded around’ and *kumekke*, ‘there’, within a single intonation phrase, and a relationship of upstep between the accents on *bene-nang*, ‘the two of them saw/had seen’ and *korroko*, ‘already’. Figures 6.1 and 6.5 together indicate that the domain of relative prominence relations is the intonation phrase. As discussed in Chapter 3, section 3.12, relative prominence relations such as these bear a relationship to discourse focus, though it is not within the scope of this thesis to develop a detailed analysis of this relationship.\(^9\)

---

\(^7\) Excluding the ‘clitic group’ posited in Nespor and Vogel (1986), which remains a subject of contention in the literature.

\(^8\) The cue to the first intonation phrase boundary after *kun-mekke* is somewhat minimal in this example: the peak of the accent on *na-djamun* is only slightly, but audibly, higher than would be expected for a second downstepped peak following *kun-mekke*, indicating a slight pitch reset.

\(^9\) As described in Chapter 5, section 5.5.2.1, downstep and upstep also occur between accents within a single phonological word, as in raised and downstepped peak hat patterns; it is not presently clear to what extent this phenomenon is distinct from relative prominence relations between phonological phrases.
Relative prominence relations between phonological phrases in two intonation phrases: *bene-dapkeng kumekke* ‘they squeezed in there together’ and *bene-nang korroko*, ‘they had already seen him’. The arrows indicate the relevant accent peaks.

Transcription: bene-dapkeng kumekke bene-nang korroko
Gloss: 3uaP-crowd.togetherPP LOC.ANA.IMM. 3uaP-seePP already
Translation: ‘They squeezed in there together; they had already seen him.’

**Sound file 6.5**

### 6.4 Phonetic realisation of the $L_p$ tone at three prosodic boundary levels: acoustic cues to levels of prosodic constituency

#### 6.4.1 Literature on scaling and alignment of $L$ boundary tone targets as cues to levels of prosodic constituency

Prosodic constituent edges at the level of the IP and above tend to be demarcated by a greater number and/or greater magnitude of acoustic-phonetic correlates, the higher the constituent is in the prosodic hierarchy (e.g. Frota, 1998 (European Portuguese); de Pijper and Sanderman, 1994 (Dutch); Gussenhoven and Rietveld, 1992 (English); Beckman and Edwards, 1990 (English)). For example, in Dutch, ‘temporal and melodic’ cues to intonation phrase boundaries distinguish these boundaries from phonological phrase boundaries, which lack such boundary cues (Blaauw, 1994, cited in Frota, 1998).

The predominant boundary cues investigated in the intonational literature are the duration of syllables and segments immediately preceding the prosodic boundary; scaling of $L$ boundary tones (principally in the context of above-IP levels of
constituency and ‘final lowering’), and contour variations attributable to the coincidence of tones associated with higher and lower prosodic constituent boundaries (such as the intermediate phrase tone and the intonational boundary tone in English). I will defer discussion of the literature on preboundary lengthening to section 6.5.1 below, and address scaling and alignment in this section. In Chapter 2, section 2.3.4, I discussed the only boundary tone sequence observed in BGW – Lp plus an intonational boundary tone, H\%.

In their detailed study of the tonal system of Japanese, Pierrehumbert and Beckman (1988) examine the behaviour of phrase-final L% tones at the boundaries of accentual phrases, intermediate phrases and utterances. They observe a lowering of those accentual phrase-final L% tones which coincide with the right boundary of an intermediate phrase (the next highest level of prosodic constituency), relative to those which occur intermediate phrase-medially. In order to account for this extra lowering, they suggest that phonetic realisation mechanisms ‘read off’ the strength of the prosodic constituent boundary and interpret that strength in terms of lower F0 scaling of the L tone for a higher-level boundary (1988: 135):

> It may be that an intermediate phrase has no more direct tonal marking. Its boundaries will have consequences for the durations of segments on the phoneme tier, but its realisation in the tone tier may be entirely a matter of tone scaling for boundary strength and the resetting of the pitch range parameter [i.e. pitch reset at the onset of a new phrase - JB]…

Pierrehumbert and Beckman also distinguish ‘strong’ and ‘weak’ variants of phrase-initial L% tones, suggesting that “by lengthening its duration and by lowering its pitch relative to that of adjacent H tones, a L tone can be made prosodically stronger.” (1988:29).

Final L boundary tones have been more extensively studied in the literature than initial boundary tones. The correlation Pierrehumbert and Beckman observe between prosodic boundary strength and the F0 depth of the initial L boundary tone has also been frequently observed, cross-linguistically, in relation to final L boundary tones. In particular, a finding that L boundary tones are lowered as one index of higher-level phrase-finality (e.g., at the end of IPs, utterances, or discourse paragraphs) is common in the literature (cf., for example, Fletcher and Evans (2000); Swerts, Collier and Terken (1994) and Swerts, Bouwhuis and Collier (1994) on Dutch; Pierrehumbert and Beckman, 1988 on Japanese; Liberman and Pierrehumbert
(1984) and Pierrehumbert (1980) on English; Prieto (1998) on Spanish). Typically, the final pitch accent of the phrase is also lowered, if sufficiently close to the end of the phrase. Liberman and Pierrehumbert (1984) calculate that final lowering affects the final 500ms of the intonation phrase, in English.

In a study of intonational downtrends in spontaneous narrative speech in the Gun-Djeihmi and Kundedjnenghmi dialects of BGW, Fletcher and Evans (2000) found significant final lowering of the L boundary tone in some intonation phrases. While the relationship between final lowering and the height of the final accent in the IP was not specifically examined in their study, a comparison of the F0 height of initial and final accents in all IPs (with and without final lowering) produced inconclusive results: the height of the second accent was found to be significantly lower in two texts, but not significantly lower in two others. One of the texts in each group was by the same speaker.

Pierrehumbert and Beckman (1988) suggest that the duration of a low boundary tone might also be correlated with the perceived ‘strength’ of the tone. This suggestion has not been made elsewhere in the literature in relation to boundary tones, as far as I am aware. The ‘duration’ of the L tone in Japanese is related to its alignment with the phrase-initial mora (at the onset of the mora only, or extending across the mora):

In the case of initial accent the first tone-bearing unit in the phrase must realize the H tone of the accent as well as the boundary L%. The L tone cannot have the extended duration that it has when it alone is associated with the first syllable. Also, the rise to the immediately following H tone must be considerably steeper for the accent to be realized on the correct syllable.

Pierrehumbert and Beckman observe that the more rapid rise from L% to the H of the accentual phrase results in the perception that the initial L target is higher in pitch than an initial L% which solely occupies the duration of the initial tone-bearing unit – or even that the L tone is absent altogether. They cite a study by Nabelek et al. (1970), which suggests that “both the shorter duration and the steeper rise would produce a sensation of higher pitch for the phrase-initial L in the accented syllable.” (1988: 29)10

10 House (1990: 31) cites a finding by Rossi (1971, 1978) that a rising tonal movement in the order of two to four semitones, and across a vowel of 50 - 200 ms duration, may be perceived as a level tone at the F0 level reached approximately two-thirds into the vowel. Some such perceptual mechanism would seem evident in Pierrehumbert and Beckman’s finding that more rapid rises from a low target in Japanese are perceived as higher in pitch than rises from a low target with a longer duration at the low level.
In Kuninjku, the alignment of the Lp tone varies between the penultimate and the final syllable of the phrase, with a tendency to align at the right edge of either syllable. No factors conditioning this variation in alignment are immediately apparent. The experiment reported below seeks to determine if there is any relationship between the phonetic alignment of the tone and the strength of the upcoming prosodic boundary. Penultimate alignment may lend the Lp tone greater perceptual salience as such, since the final syllable in this case carries low level tone (the low tone is of longer duration). If the increased phonetic duration of a low boundary tone can correlate with a perception of the ‘strength’ or lowness of the low tone in Japanese, it is conceivable that an earlier alignment of the Lp tone and consequent longer phonetic duration of the tone (across the entire final syllable), might correlate with boundary strength in Kuninjku.

On the other hand, the earlier alignment of the low tone might relate not to the higher phonological level of the upcoming boundary per se, but, like final lowering (Fletcher and Evans, 2000), to the location of that boundary within the discourse segment. The notion of boundary strength relevant to the alignment of the Lp boundary tone might be the finality of the boundary within the discourse.

6.4.2 Aim of the experiment
The aim of this experiment is to determine whether there are significant differences in the scaling and/or alignment of the Lp boundary tone when the end of the phonological phrase coincides with the end of either an IP or an utterance. A further aim is to determine whether there is any correspondence between earlier (i.e. penultimate) alignment of the Lp boundary tone and finality of the phrase within a discourse segment.

6.4.3 Method and materials
The corpus used to investigate the scaling and alignment of the low tones consists of the three narratives by the Kuninjku speaker MK2 (BILLABONG, CUCKOO and NAMALADJ) and the elicitation session with the same speaker (KUNKURRNG).

IP-medial, IP-final and utterance-final Lp tones were labelled on a separate tier in the ESPS Waves+ Transcriber interface. Each of these boundary levels corresponds to a label on the Break Index (BI) tier: IP-medial = BI 1; IP-final = BI 3; utterance-final = BI 4. Only tones for which a well-defined F0 target could be determined were
labelled. By ‘well-defined’ I mean a target labelled at the lowest point in a stable region of the F0 trace (i.e. showing a consistent direction of F0 movement and little or no scatter). Measurements were not taken from traces too scattered by vocal fry or segmental perturbation to allow the recovery of an unambiguous F0 target. An ‘L’ label on the intonation transcription tier has been used to indicate the point at which the value of the low target is extracted (this tier is labelled “phon_tone” in the illustrations to this chapter). Where the F0 levels off after a fall, the L target is located at the first point at which a steady low F0 level is reached. Any difference between the location of the ‘L’ label in the phonetic tone transcription tier and the location of the Lp label at the edge of the phonological phrase-final word is the difference between the precise phonetic alignment of the tone target and the phonological association of the Lp tone (with the right edge of the phonological phrase).

F0 values for the low tones (in Hertz) were extracted at the L tone label points (indicated with arrows in Figure 6.6) using mu+ (Harrington et al., 1993), a multi-dimensional database interrogation system interfaced with the S-Plus statistical package.

Figure 6.6: Illustration of the labelling of phonetic L tone targets for F0 extraction, using the Transcriber shell (top tier). The lower two arrows indicate the location of the L tone targets in the F0 trace.

Transcription: makka djalamardawk
Gloss: VE.ANA.IMM. bush.passionfruit
Translation: ‘that one (I was just talking about), bush passionfruit’.
The alignment of each L tone target relative to the end of the accented word was also annotated and correlated with the scaling measurement for that tone. The frequencies with which the L tone aligned with (i) the word-penultimate syllable and (ii) the word-final syllable were calculated for words in which one or two unaccented syllables separated the accented syllable from the word edge, and for IP-medial, IP-final and utterance-final positions.

The separation of the accented syllable from the word edge was taken into account in order to control for a possible effect of ‘tonal crowding’. For example, it was considered that the L tone might show a greater tendency to align earlier (i.e. with the penultimate rather than the final syllable) in contexts where there was greater distance in syllables between the H* accent and the following L tone.

Finally, phrase position was factored in in order to test whether the level of the upcoming prosodic boundary affected the alignment of the low tone – as a possible correlate of boundary strength per se, or of finality within a discourse segment.\footnote{Another possibility considered was that earlier alignment might correlate with the presence of a second L tone, associated with the intonational phrase or utterance level edge. However, this possibility would require the two tone targets to take more time to be realised than one, an assumption for which there is no evidence in the} In order to test the latter hypothesis, the F0 values of utterance-final L tones were classified according to whether the tone was aligned with the penultimate syllable or the final syllable. The mean values of the two sets of tones were compared, in the expectation that if there was any correlation between earlier L tone alignment and final lowering, it would be reflected in a lower mean F0 value for the earlier aligned L tones.

6.4.4 Results: \( L_p \) scaling and prosodic boundary strength

Table 6.1 and Figure 6.7 display the distribution of F0 values for \( L_p \) tones in PhonP-final, IP-final and utterance-final positions. The distribution of F0 values in PhonP-final and IP-final positions is remarkably similar, while the F0 values of \( L_p \) tones in utterance-final position are lower on average. An ANOVA carried out on the values of \( L_p \) tones in the three phrase positions is highly significant (\( p=0, F=136.59 \)). Post-hoc pairwise comparisons confirm that utterance-final \( L_p \) tones are significantly lower in mean F0 than both the PhonP-final and the IP-final tones (IP-medial/utterance-final: \( p = 0, F = 237.59 \); IP-final/utterance-final, \( p = 0, F = 170.62 \)),

\footnote{Another possibility considered was that earlier alignment might correlate with the presence of a second L tone, associated with the intonational phrase or utterance level edge. However, this possibility would require the two tone targets to take more time to be realised than one, an assumption for which there is no evidence in the}
while the F0 values of PhonP-final and IP-final Lₚ tones indicate no significant difference in the scaling of the tones in these two positions (p > 0.05).

These results indicate that the difference in prosodic level between the phonological phrase and the intonation phrase is not reflected in the scaling of Lₚ tones at the respective boundaries: an Lₚ tone which coincides with an IP boundary is not lower, on average, than one which occurs IP-medially.

The lower average F0 value of Lₚ tones in utterance-final position appears to be a consequence of the same (optional) utterance-final lowering of L boundary tones that Fletcher and Evans (2000) have observed in relation to the Gundjiehmi and Kundedjnjenghmi dialects. The fact that the lowering is optional suggests that lower F0 is not a direct correlate of the increased boundary strength at utterance level, but it is an indirect correlate, since lowering does not occur at any lower level of prosodic phrasing.

<table>
<thead>
<tr>
<th></th>
<th>Utterance-final (n = 270)</th>
<th>IP-final (n = 110)</th>
<th>Phonological phrase-final (n = 193)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min.</td>
<td>86.6</td>
<td>103.7</td>
<td>96.9</td>
</tr>
<tr>
<td>1st Qu.</td>
<td>111.8</td>
<td>146.8</td>
<td>146.5</td>
</tr>
<tr>
<td>Median</td>
<td>123.5</td>
<td>164.5</td>
<td>165.7</td>
</tr>
<tr>
<td>Mean</td>
<td>128.2</td>
<td>166.3</td>
<td>170.2</td>
</tr>
<tr>
<td>3rd Qu.</td>
<td>137.9</td>
<td>183.2</td>
<td>193.5</td>
</tr>
<tr>
<td>Max.</td>
<td>237.2</td>
<td>268.9</td>
<td>271.1</td>
</tr>
</tbody>
</table>

Table 6.1: Distribution of F0 values for Lₚ (Hz) by phrase position

intonational literature. Differences in alignment therefore could not provide unambiguous evidence in favour of an additional L boundary tone.
Figure 6.7: Boxplots of the phonological phrase-final (first plot from left), IP-final (second plot) and utterance-final F0 values (Hz) for Lp

6.4.5 Results: Lp alignment and prosodic boundary strength

This experiment examined whether prosodic factors such as the strength of the upcoming prosodic boundary, and the relative proximity of the H* accentual tone to the boundary (in syllables), influence the alignment of the Lp tone.

A Chi-square analysis indicates that boundary strength has a weak, but significant, effect on the frequency with which the Lp tone aligns with the penultimate vs. the final syllable of the phrase ($\chi^2 = 9.32; p < 0.05$). The Lp aligns most frequently with the penultimate syllable before an utterance-level boundary.

The data presented in Table 6.2 (below) is drawn only from phrases in which either one or two unaccented syllables separate the preceding H* accent from the phrase edge (the two groups – one or two unaccented syllables – are not distinguished in the Chi-square statistic cited above). Where one unaccented syllable separates the H* tone from the boundary, penultimate alignment means the fall is completed (the Lp target is reached) on the H* accented syllable itself. It is possible that this ‘tonal crowding’ has an effect on the alignment of the Lp tone.

Impressionistically, the figures suggest that the alignment of the Lp tone is affected by the number of syllables separating the preceding H* accent from the boundary associated with the Lp tone. In phonological phrase-final position, there is
quite a strong preference for aligning the Lₚ tone with (the right edge of) the final syllable, when only one syllable separates the H* accented syllable from the boundary. This is also true, though to a slightly lesser extent, of IP-final boundaries. When two syllables separate the H* tone from the boundary, there is still a preference for final syllable alignment in both PhonP-final and IP-final positions, but it is somewhat less strong than with one syllable separation. In contrast, before utterance boundaries, the frequency of penultimate syllable alignment increases (relative to the lower-level boundaries) for both the one syllable and the two syllable categories, but the increase is relatively greater where only one syllable precedes the boundary. Thus, there appears to be an interaction between boundary strength and distance to the preceding H* accent (see Table 6.3), such that a stronger upcoming boundary increases the preference for earlier Lₚ tone alignment.

<table>
<thead>
<tr>
<th>Phonological phrase-final boundary</th>
<th>Penultimate syllable</th>
<th>Final syllable</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alignment of Lₚ tone</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Lₚ targets [Total: 167]</td>
<td>29</td>
<td>138</td>
</tr>
<tr>
<td>% of Lₚ targets</td>
<td>17%</td>
<td>83%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IP-final boundary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alignment of Lₚ tone</strong></td>
</tr>
<tr>
<td>Number of Lₚ targets [Total: 98]</td>
</tr>
<tr>
<td>% of Lₚ targets</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Utterance-final boundary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alignment of Lₚ tone</strong></td>
</tr>
<tr>
<td>Number of Lₚ targets [Total: 250]</td>
</tr>
<tr>
<td>% of Lₚ targets</td>
</tr>
</tbody>
</table>

Table 6.2: Frequency of penultimate vs final syllable alignment of Lₚ before phonological phrase-final, IP-final and utterance-final boundaries.
### Table 6.3: Frequency of penultimate vs final syllable alignment of $L_p$ before phonological phrase-final, IP-final and utterance-final boundaries, when 1 or 2 syllables separate the preceding H* accented syllable from the boundary.

<table>
<thead>
<tr>
<th></th>
<th>Penultimate syllable</th>
<th>Final syllable</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phonological phrase-final boundary</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\text{Alignment of } L_p$ $\text{ tone}$</td>
<td>$\text{dist (H* to boundary) = 1 syll}$</td>
<td>$\text{dist (H* to boundary) = 2 sylls}$</td>
</tr>
<tr>
<td></td>
<td>9 (8%)</td>
<td>20 (34%)</td>
</tr>
<tr>
<td></td>
<td>99 (92%)</td>
<td>39 (66%)</td>
</tr>
<tr>
<td><strong>IP-final boundary</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\text{Alignment of } L_p$ $\text{ tone}$</td>
<td>$\text{dist (H* to boundary) = 1 syll}$</td>
<td>$\text{dist (H* to boundary) = 2 sylls}$</td>
</tr>
<tr>
<td></td>
<td>12 (20%)</td>
<td>15 (39%)</td>
</tr>
<tr>
<td></td>
<td>48 (80%)</td>
<td>23 (61%)</td>
</tr>
<tr>
<td><strong>Utterance-final boundary</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\text{Alignment of } L_p$ $\text{ tone}$</td>
<td>$\text{dist (H* to boundary) = 1 syll}$</td>
<td>$\text{dist (H* to boundary) = 2 sylls}$</td>
</tr>
<tr>
<td></td>
<td>73 (47%)</td>
<td>47 (49%)</td>
</tr>
<tr>
<td></td>
<td>82 (53%)</td>
<td>48 (51%)</td>
</tr>
</tbody>
</table>

Utterance-finally, low tones tend to be realised lower in the speaker’s pitch range than in IP-final or PhonP-final positions. This utterance-final lowering of some low tones means that the last syllable is more prone to creak or ‘vocal fry’, which often occurs when the lower limit of the speaker’s pitch range is reached, and which results in perturbation of the F0 trace. While it is therefore possible that more utterance-final, final-syllable-aligned low tones could have been excluded from the analysis on the basis of the trace being too perturbed to extract a reliable measurement, leading to a bias away from final syllable alignments in the frequency counts, a retrospective examination of the data showed that this was not in fact the case. The increased
frequency of penultimate alignment of Lp tones before utterance boundaries does appear to be an effect of boundary strength at utterance level.

6.4.6 Results: Lp alignment and finality

It was further hypothesised that an earlier alignment of the utterance-final Lp tone (i.e. penultimate alignment) might serve as a cue to finality, possibly in conjunction with final lowering.

The results presented in Table 6.4 indicate that there is no association between lower scaling (final lowering) and penultimate alignment of the utterance-final Lp tones (Wilcoxon rank-sum test: p>0.05).

<table>
<thead>
<tr>
<th>Penultimate syllable aligned Lp tones</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n = 120)</td>
</tr>
<tr>
<td>Min.</td>
</tr>
<tr>
<td>86.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Final syllable aligned Lp tones</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n = 130)</td>
</tr>
<tr>
<td>Min.</td>
</tr>
<tr>
<td>91.5</td>
</tr>
</tbody>
</table>

Table 6.4: Distribution of utterance-final Lp tone values (Hz) by alignment

6.4.7 Discussion: Final lowering as absolute vs relative low F0 level, and its relationship to the percept of finality

Final lowering can have two definitions: one perceptual, the other, acoustic. Wichmann (1993:50) writes: “In its weakest form, [final lowering] is an F0 trough which is low in relation to preceding and following F0 minima; in its strongest form it is an F0 trough which is close to the speaker’s base line…” Thus far, I have used the term ‘final lowering’ to refer to a purely acoustic phenomenon: a lowering of the F0 level of some utterance-final Lp boundary tones, to, or close to, the speaker’s baseline (approx. 100-110 Hz). As discussed in section 6.4.4, this lowering effect is sufficiently strong as to produce a statistically significant difference between
utterance-final $L_p$ tones as a group – including those tones which are not final-lowered – and PhonP-final and IP-final $L_p$ tones. Table 6.1 showed that half of all utterance-final $L_p$ tone values measured fell below 123.5 Hz. This suggests that nearly half of all utterance-final $L_p$ tones approach the baseline of the speaker’s pitch range; moreover, this figure is likely to be an underestimate, since F0 perturbation effects at low F0 levels make it difficult to always measure the lowest audible point of the contour.

In the literature, final lowering is frequently associated with a percept of \textit{finality}. The idea is that a declarative phrase which undergoes final lowering tends to be perceived as concluding a discourse segment. However, the percept of finality depends on more than simply the final F0 value of a low boundary tone and its proximity to the speaker’s baseline. There is clear evidence that in English, it depends on the height of the final accent in the phrase (cf. Wichmann, 1991; Liberman and Pierrehumbert, 1984). That is, the lower the final accent, the more likely the phrase is final. Impressionistically – on the basis of the Kuninjku data – it seems that the perception of final lowering could also depend on the relative height of the low boundary tone in the immediately preceding phrase. However, I do not know of any study directly bearing on this question.

Figure 6.8 and Figure 6.9 illustrate acoustic final lowering of $L_p$ at the utterance level, while Figure 6.10 illustrates a contour which reaches a similar low target, but does not give an impression of finality – possibly because the preceding phrase-medial $L_p$ tone is scaled at a similar F0 level to the utterance-final tone. The low F0 values of the utterance-final $L_p$ tones in Figures 6.8 to 6.10 are 100Hz, 120Hz and 110Hz respectively. The highest accent peaks in Figure 6.10 are also much lower than in Figure 6.8 or 6.9, suggesting a somewhat compressed pitch range across this utterance.
Figure 6.8: Utterance with final lowering, L_p tone aligned with the right edge of the final syllable (bonj). The first arrow indicates the L_p tone in the pre-final phrase, the second arrow the final-lowered L_p tone.

Transcription: man-korle bene-karrmeng bonj
Gloss: III-spear 3uaP-takePP that’s.it
Translation: ‘The two of them had spears, then they were ready.’

Sound file 6.6

Figure 6.9: Utterance with final lowering, L_p tone aligned with the right edge of the penultimate syllable of ben-bom. The first arrow indicates the L_p tone in the pre-final phrase, the second arrow the final-lowered L_p tone.

Transcription: bene-nah-nang ben-bom
Gloss: 3uaP-REDUP-seePP 3/3aP-killPP
Translation: ‘The two of them watched him kill them.’
6.5 Non-tonal acoustic correlates of boundary strength: duration

The analysis of segment durations in relation to metrical strength in Chapter 4, section 4.6.1, showed incidentally that the duration of both accented and unaccented syllables increased in IP/utterance-final feet, relative to PhonP-final feet. In this experiment, I examine segment durations in IP-final and utterance-final feet separately for phrase-final lengthening effects at each level. The distinction between IP and utterance levels was not made in the experiment reported in Chapter 4, which was principally concerned with duration as a correlate of metrical strength and accent.
Preboundary lengthening, or increased segment durations in one or more syllables immediately preceding a prosodic boundary, is a very commonly reported phenomenon across languages, though languages differ as to the prosodic levels which trigger lengthening. In a study of positional prosodic effects on duration and vowel quality in Muskogean Creek, Johnson and Martin (2002) report utterance-final lengthening of vowels in that language, and cite a large number of other studies of European languages (Swedish, Dutch, German, Spanish, French, Italian, Russian, Czech, Finnish and Hungarian) and non-European languages (Hebrew, Japanese, Mandarin) in which final lengthening effects have been observed at one or more levels of the prosodic hierarchy.

Preboundary lengthening of utterance-final vowels has been found to occur in the Australian languages Dyirbal (King, 1994: 64), Warlpiri (Harrington, Butcher and Palethorpe, 2000; Pentland and Ingram, 2001), Dalabon (Fletcher and Evans, in press), and the Kundedjnjenghmi dialect of BGW (Fletcher and Evans, in press). King (1994) reported that utterance-final lengthening occurred irregularly in her Dyirbal data, and also that there was variability between speakers as to the frequency with which it occurred. King also found that a nasal coda segment in the utterance-final syllable sometimes carried final lengthening instead of the vowel. Harrington, Butcher and Palethorpe (2000) do not distinguish IP-final and utterance-final contexts in their elicitation of lists of three tokens of the same word, so it is not entirely clear whether the final lengthening observed in Warlpiri occurs both in IP-final and utterance-final positions, or only the latter. None of these studies has examined segment durations at lower level prosodic boundaries. Pentland and Ingram (2001) report utterance-final lengthening of the final syllable in trisyllabic words. The vowel of this syllable is strongly affected by the lengthening, being 50-60% longer than vowels in other positions in the word.

Lengthening of preboundary segments is also commonly associated with the intonation phrase level. For example, Frota (1998: 163) found “a clear, systematic and significant difference in durational effects associated with a φ [phonological phrase – JB] and an I-boundary [intonation phrase boundary – JB]” in European Portuguese, while Wightman et al. (1992) reported a significant difference in the mean normalised duration of preboundary vowels between intermediate (break index 3) and intonation phrase levels (Break Index 4) in English, but not between the
intonation phrase level and any higher level unit. Preboundary lengthening at intonation phrase level has also been observed in languages including Dutch (de Pijper and Sanderman, 1994), Chichewa (Kanerva, 1990) and Creek (Johnson and Martin, 2002). Nespor and Vogel (1986: 176) claim that the phonological phrase is a domain of preboundary lengthening in Italian, without, however, presenting any phonetic evidence for the claim, and without specifying which segments are affected by the lengthening.

6.5.2 Aim of the experiment
In section 6.4, I showed that there are no significant differences in the scaling or alignment of the Lp tone in PhonP-final and IP-final positions. One possibility is that, in the absence of tonal cues, there are distinct durational cues to these two levels of disjuncture. The aim of this experiment is to determine whether there is any evidence that vowel durations serve as a correlate of, and potential perceptual cue to, distinct levels of boundary strength in BGW.

6.5.3 Method and materials
A subset of phrase-final feet were examined, drawn from across three texts by Kuninjku speaker MK2 (CUCKOO, BILLABONG and NAMALADJ). More data was labelled for this experiment than in the earlier experiment reported in Chapter 4. Disyllabic feet with an accent on the metrical head and a low tone on the final syllable were selected in PhonP-final position (n = 48), IP-final position (n = 40) and utterance-final position (n = 56). Final trisyllabic and monosyllabic feet were not examined, in order to control for effects of foot length on duration. Contrary to the procedure in the experiment in Chapter 4, only vowel durations were measured in this experiment: the vowel appears to be most consistently sensitive to boundary-related prosodic lengthening effects across languages, while onset and coda segments tend to show more variability in their sensitivity to lengthening (Fletcher, 1991 (French); Wightman et al. 1992, Cooper and Danly, 1981 (English)). Vowels were also measured in order to avoid combining in the data set voiced coda segments, such as nasal consonants, which have a clear duration, with voiceless and unreleased stop segments, the presence of which is mostly evident in the transition from the vowel.
This is particularly important in this experiment because the number of tokens examined is quite small.

The duration of the accented and unaccented vowels was extracted using the mu+ (Harrington et al., 1993) “mudur” routine. The identity of the vowel (ignoring slight variations in vowel quality, between more tense and lax pronunciations) was labelled as /a/, /e/, /i/, /o/ or /u/. However, in the final results, the vowels for each phrase boundary category were compiled, since no trends toward significant differences in vowel duration based on vowel identity were apparent in the raw data.13

6.5.4 Results

A separate ANOVA was carried out on the accented and unaccented sets of vowels across the three prosodic boundary conditions. The mean vowel durations in all conditions are presented in Table 6.5. Examining the overall set of accented vowels first, there is a significant difference in the average duration of the vowels in the three prosodic boundary contexts (F = 15.56, p < 0.001). Post-hoc pairwise ANOVAs show that the locus of the significant difference is the utterance-final vowels, which are significantly longer than both PhonP-final vowels (F = 24.10, p < 0.001) and IP-final vowels (F = 18.63, p < 0.001). There is no statistical difference between the average durations of the vowels in PhonP-final and IP-final positions (p > 0.05).14

Turning to the unaccented vowels, an overall ANOVA again indicated a significant difference in the vowel durations in the three pre-boundary contexts (F = 12.53, p < 0.001). Post-hoc pairwise comparisons showed that these vowels are also significantly longer in utterance-final position than in PhonP-final (F = 15.83, p < 0.001) or IP-final (F = 18.04, p < 0.001) positions. Again, there was no significant difference in duration between unaccented vowels which are final in a phonological phrase and final in an intonation phrase (p > 0.05).

12 Although Horne, Strangert and Heldner (1995) find significant utterance-final lengthening only in the coda consonant of the preboundary syllable of Swedish.
13 Differential effects of prosodic lengthening (final lengthening and accent-related lengthening) on different vowels may, however, be one parameter of phonetic variation across languages; for example, Fletcher (1991) found effects of vowel height on intonation phrase-final lengthening of accented syllables in French, such that /i/ vowels tended to undergo greater lengthening than /a/.
14 Similar results were obtained using a non-parametric statistical test, the Wilcoxon Rank-Sum test.
Table 6.5: Vowel duration (ms) of accented (penultimate) and unaccented (final) syllables in PhonP-final, IP-final and utterance-final feet

<table>
<thead>
<tr>
<th></th>
<th>PhonP-final, accented</th>
<th>Phons-final, unaccented</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min.</td>
<td>Mean</td>
</tr>
<tr>
<td>IP-final, accented</td>
<td>48</td>
<td>87</td>
</tr>
<tr>
<td>IP-final, unaccented</td>
<td>38</td>
<td>81</td>
</tr>
<tr>
<td>Utterance-final, accented</td>
<td>46</td>
<td>103</td>
</tr>
<tr>
<td>Utterance-final, unaccented</td>
<td>54</td>
<td>105</td>
</tr>
</tbody>
</table>

6.5.5 Discussion

Clearly, there is an effect of utterance-final juncture on vowel duration which extends throughout the final foot. This finding echoes the findings above for scaling differences in the $L_p$ tones in utterance-final vs non-final positions, which showed a tendency for $L_p$ tones to be stronger – i.e. to be scaled lower – at utterance-final boundaries.

This finding also indicates that the distinction between phonological phrase and intonation phrase constituents is not marked by durational differences between the final vowel segment at the right boundary of either unit, when that unit ends in a low boundary – the most common boundary type.

As Table 6.5 shows, the difference between the mean durations of accented and unaccented vowels preceding utterance junctures vs phonological phrase and IP junctures is in the order of 15 - 20 ms. The just noticeable difference threshold for duration differences is 10 to 40 ms (Lehiste 1970: 13, 17); the JND is smaller for segments with greater intensity. Therefore, it is possible that this difference in vowel length utterance-finally is perceptible in at least some cases.
6.6 Tonal register as evidence for the phonological phrase

6.6.1 Phonetic tone scaling within a prosodic domain

A study by Liberman and Pierrehumbert (1984) suggests that phonetic tone scaling within a phrase domain may serve as evidence for the domain in question. In the following sections, I examine the possibility that phonetic tone scaling effects due to tonal register manipulations may serve as evidence for the phonological phrase level in Kuninjku. By ‘tonal register’ I mean an interdependence in the scaling of F0 values of H and L tones within the phrase, such that, for example, a lowering of H tones within the phrase will generally be accompanied by a corresponding lowering of L tones.

Liberman and Pierrehumbert (1984) observe a statistically significant scaling relationship between high accent-related peaks and the following low boundaries within utterance-medial intonation phrases. Across four subjects, the height of the preceding peak accounts for between 10% and 82% of the variation in the height of the following low points, utterance-medially.15 Utterance-finally, they find no significant relationship between the two in one sentence type, and a much lesser correlation in another. The relationship is obscured in this position principally by the additional effect of final lowering on the scaling of the low boundary (Liberman and Pierrehumbert, 1984:179).

In relation to Kuninjku, a correlation between the F0 value of each Lp tone and the F0 value of the final H* peak within the phonological phrase would indicate a scaling relationship between H and L tones within the phrase. Most phonological phrases contain only one word, and words which carry two accents typically exhibit a flat hat pattern; differences in relative prominence between two word-internal accents, such as the downstepped and raised peak patterns analysed in Chapter 5, are relatively rare. Correlating the value of the phrase-final H* peak and the Lp tone is therefore likely to give a good indication of the relative (in)dependence of H and L scaling within the phonological phrase.

A related issue is the relative variability of H and L tones generally. A greater amount of variability in the range of high tones than of low is quite common across stress accent languages (Bruce and Touati, 1990; Liberman and Pierrehumbert, 1984), though Prieto (1998) also found considerable variability in the scaling of low tone
targets located between high and downstepped high pitch accents. Liberman and Pierrehumbert found significantly smaller deviation-to-mean ratios for L tones than for H in English (1984:179). On the basis of this result, they suggested that there is intrinsically less variation in the value of L tones by virtue of their proximity to the speaker’s baseline. They present this as phonetic evidence for the observation that pitch values at the baseline are (evidently, within a small range) “constant”, relative to the variability observed in tones elsewhere in the speaker’s tonal space. The alternative would be that “pitch changes involve scaling by a multiplicative constant” such that “the effect [of variation in pitch range, measured in Hz] on lower pitches would be systematically smaller than the effect on higher ones, without any implication that the bottom end of the system is ‘constant’.” (1984:179)

6.6.2 Aim of the experiment
The aims of this experiment are to determine whether H* and Lp tones are scaled in relation to one another within the phonological phrase in Kuninjku and to determine whether there is any evidence for greater variability in the scaling of H tones than of L tones.

6.6.3 Method and materials
The texts used in the experiments described in sections 6.4 and 6.5 were also used in this experiment. F0 measurements for the H* peaks were made in the manner described in Chapter 5, section 5.4.4. F0 measurements for the Lp tone were carried out as described in section 6.4.3 in this chapter. The H* accent peak preceding each L tone was labelled, and these F0 values were extracted. The accent peak F0 values were then manually matched with the following L tone F0 values. Data frames combining the two sets of F0 values were manually constructed for each phrase position – IP-medial (PhonP-final); IP-final; and utterance-final – using the SPlus statistical software package. A non-parametric statistical test, Spearman’s rho, was used to analyse correlations.

Liberman and Pierrehumbert (1984) measure the relative F0 variability of H and L tones by dividing the standard deviation by the mean F0 for each set of tones (1984: 179). I have adopted the same procedure in this experiment. This procedure

15 % of variation explained = the value of $R^2$
produces a measure of variability in F0 values which is not dependent on the magnitude of the F0 values themselves (i.e. higher F0 values giving rise to higher standard deviations).

6.6.4 Results: Scaling of the \( L_p \) tone in relation to the preceding \( H^* \) peak

There is a significant correlation between the F0 height of the preceding \( H^* \) peak and the following \( L_p \) tone in each phrase position (see Table 6.6 below). This indicates that the \( L_p \) tone is in fact scaled in relation to the preceding \( H^* \) peak, such that, generally speaking, \( L_p \) tones are higher when preceded by higher peaks.

There is, nonetheless, considerable variability within the relationship: the height of the preceding peak accounts for between 26% and 57% of the variation in the height of the \( L_p \) tone\(^{16}\). Interestingly, the proportion of the variability explained is similar in phonological phrase-final and IP-final positions, providing another measure of the extent to which the upcoming IP boundary has little effect on tone scaling within the IP-final phonological phrase (see Table 6.6 and Figures 6.11 – 6.14). In contrast, the amount of variability in the scaling of \( L_p \) explained by the preceding \( H^* \) is considerably diminished in utterance-final position.

![Figure 6.11: Combined plot of the F0 of the preceding \( H^* \) peak vs the following \( L_p \) tone in all phrase positions: PhonP-final (p), IP-final (i) and utterance-final (u).](image)

\(^{16}\) These percentages are obtained by squaring the \( \rho \) correlation.
<table>
<thead>
<tr>
<th>Phrase Position</th>
<th>PhonP-final</th>
<th>IP-final</th>
<th>Utterance-final</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean F0 of preceding H* peak (Hz)</td>
<td>227</td>
<td>223</td>
<td>201</td>
</tr>
<tr>
<td>Mean F0 of Lp (Hz)</td>
<td>170</td>
<td>166</td>
<td>128</td>
</tr>
<tr>
<td>Correlation (Spearman's rho)</td>
<td>0.760</td>
<td>0.757</td>
<td>0.510</td>
</tr>
<tr>
<td>Significance level</td>
<td>p = 0</td>
<td>p = 0</td>
<td>p = 0</td>
</tr>
<tr>
<td>% variation in Lp tone values accounted for</td>
<td>58%</td>
<td>57%</td>
<td>26%</td>
</tr>
</tbody>
</table>

Table 6.6: Correlation between Lp tone values and preceding H* peak values (Hz) by phrase position

Figure 6.11 clearly shows a similar scaling relationship between phonological phrase-final H* and Lp tones (data points labelled “p”) and IP-final H* and Lp tones (labelled “i”). The relevant two ellipses are largely overlapping. The dissimilarity of this scaling relationship from that observed between H* and Lp tones utterance-finally (data points labelled “u”) is likewise evident. Few utterance-final Lp tones exceed 200Hz in height, and most are clustered in the region between 100 and 170 Hz.

6.6.5 Sources of variability in the scaling relationship between H* and Lp tones

Figures 6.12 to 6.14 illustrate the correlation between the preceding H* peak values and the Lp tone values for each prosodic context, and the extent, and directions, of variability in the relationship (as evident from the scatter above and below the regression line).
Figure 6.12: F0 (Hz) of Lp tones vs preceding H* peak values in PhonP-final position

Figure 6.13: F0 (Hz) of Lp tones vs preceding H* peak values in IP-final position

Figure 6.14: F0 (Hz) of Lp tones vs preceding H* peak values in utterance-final position
An analysis of the graphs in Figures 6.12 to 6.14 suggests possible sources of variability in H* and L_p tone scaling. These sources are orthogonal to the basic relationship between H* and L_p tone scaling within the phonological phrase that is indicated by the statistically significant correlation between the F0 values. These sources of variability are likely to account for some of the 42 - 74% of variation in H* and L_p tone scaling not accounted for by the basic scaling relationship between the tones. The following aspects can observed:

(a) most data-point scatter around the regression lines occurs in the upper region of H* values for this speaker (above 250 Hz), in each boundary context;
(b) in all three contexts, this scatter diverges predominantly on the upper side of the regression line. This means that in the upper range of H* peaks, the following L_p tones are generally lower in F0 than expected for these H* values;
(c) in the utterance-final context, the L_p values are mostly concentrated in a band roughly between 100 and 170Hz, even when the H* F0 values are in the upper range of F0 values, at 250 to 300Hz.

These observations point to three principal sources of variability in the scaling relationship between H* and L_p within the phonological phrase.

The first source of variability is H* tones in the upper range of H tones corresponding to L_p tones in the lower range of L tones. That is, lowering of the bottom of the register without corresponding lowering of the topline (see Figure 6.14, in particular). This kind of variability is predominantly found in the utterance-final data, and is attributable to the effect of final lowering on the L_p tones. It appears that final lowering does not necessarily affect the height of the preceding peak; rather, this peak appears to be independently constrained by the requirements of relative prominence between phonological phrases. Note that the difference between utterance-final L_p tones and non-utterance-final tones is captured in the tonal space model by the distinction between the bottom of the register and the bottom of the speaker’s range.

The second source of variability is unusually high H* tones – in the upper range of H tones – corresponding to L_p tones in the mid range of L tones. Or, a raising of the topline without a corresponding amount of raising of the bottom of the register. This is particularly evident in Figures 6.12 and 6.13. This kind of variability is found
in both utterance-final and non-final contexts. The scattering of data points above the regression line, in the upper region of the H tones (>250Hz), suggests that in this region, H tones are sometimes considerably higher than the level of the following Lₚ tone would lead one to expect. Impressionistically, H* tones in this upper region frequently seem ‘emphatic’ (see Figure 6.15/ Sound file 6.9 below). This suggests that there is a kind of ‘emphatic’ modification of local pitch register which ‘boosts’ the F0 height of the peak which is assigned the most relative prominence in the intonation phrase, without a corresponding raising of the bottom line. Such locally boosted relative prominence may also indicate contrastive or information focus (cf. Chapter 3, §3.12).
Figure 6.15: Emphatic $H^*$ pitch accent, realised as an ‘extra-high’ pitch peak; the low tone utterance-finally is not correspondingly raised.

Transcription: bi-djal-nanganang wirriwirriyak
Gloss: 3/3P-just-REDUP-seePP black.faced.cuckoo.shrike.
Translation: ‘He just watched him, that Black-faced Cuckoo-Shrike.’

Sound file 6.9

The third source of variability is $H^*$ tones in the mid-upper range of $H$ tones corresponding to $L_p$ tones in the upper range of $L$ tones (a region of tonal space in which there is significant overlap with the region in which $H$ tones are realised). Or, a raising of the bottom of the register, together with, and sometimes in excess of, a corresponding raising of the topline. For example, in Figure 6.14 (the utterance-final context), we can see three points around the rightmost end of the regression line. For these $H^*$ F0 values, the corresponding $L_p$ tone values are relatively high. There are two outlying points in the upper right corner of the IP-final graph which show a similar pattern. In the phonological phrase-final graph, there are a number of more scattered points in the $H$ tone region above 250 Hz which also correspond to unusually high $L_p$ tone values (between 200 and 275Hz).

This third type of variability results from a marked raising of the register as a whole – the bottom of the register as well as the topline. This global raising appears to be associated with the onset of quotative speech within narratives in Bininj Gun-wok (Evans, Bishop, Mushin, Birch and Fletcher, 1999). In quotative speech, speakers
may raise the tonal register in part or all of an utterance in order to mark the onset of, and/or to mimic raised voice in, direct speech. Quotative speech is not necessarily distinguished from the narrator’s own speech within a narrative by overt quotative markers (such as *ba-yimeng* or *barri-yimeng*: he/she or they said).

<table>
<thead>
<tr>
<th>tones</th>
<th>words</th>
<th>breaks</th>
<th>misc</th>
</tr>
</thead>
<tbody>
<tr>
<td>H*</td>
<td>kareh</td>
<td>ngudman</td>
<td>nakka=nuk</td>
</tr>
<tr>
<td>Lp-H*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lp</td>
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<td></td>
</tr>
<tr>
<td>H*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lp-H*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 6.16: Onset of a sequence of quotative utterances, with raised topline in both IPs.

Transcription: aah kareh ngudman nakka=nuk
Gloss: aah  maybe 2-emphatic.pronoun MA.DEM.=ignorative.particle
Translation: ‘Aah, maybe it’s you yourselves (doing it), I don’t know.’

Sound file 6.10

<table>
<thead>
<tr>
<th>H*&lt;</th>
<th>H*</th>
<th>Lp</th>
<th>H*</th>
<th>Lp-%</th>
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<tbody>
<tr>
<td></td>
<td>kareh</td>
<td>ngudman</td>
<td>nakka=nuk</td>
<td></td>
</tr>
</tbody>
</table>

If these analyses of the causes of variability in H and L tone scaling in the phonological phrase are correct, then a couple of further corollaries can be drawn regarding the use of the tonal register in Kuninjku. The first is that, generally speaking, within the mid-range of the speaker’s voice (approximately 150 - 260 Hz for this speaker), a quite steady relationship is maintained between the F0 values of an H* accentual tone and the following Lp tone. That is, the width of the tonal register tends to be fairly consistent within utterances spoken in this range. If a High tone is shifted up, i.e. if the topline is raised, the bottom of the register is raised by a comparable amount, thereby maintaining the relationship between the F0 values of the H and L tones.
The kinds of variability described above represent processes orthogonal to, and disruptive of, this maintenance of the span of the tonal register. The process of final lowering represents a downward movement of the bottom line of the tonal register significantly in excess of any corresponding lowering of the topline. Conversely, in emphatic accents, the topline may be raised, while the bottom line remains largely unchanged. A process of global upward register shift raises the bottom line of the tonal space in addition to the topline. The shift upwards of the bottom line may be in excess of the raising of the topline, creating a register that is both raised and compressed, as occurs in some quotative utterances: for example, the second phonological phrase, *kareh ngudman*, in Figure 6.16. See also Evans et al. (1999) for further details of pitch range effects in quotative utterances in a number of Australian languages.

6.6.6 Results: Degree of variability in the scaling of H and L tones

Table 6.7 (below) sets out mean (Hz) and standard deviations for the H* peaks and following Lp tones, and the ratio of the means to the standard deviations, in the different phrase positions (PhonP-final, IP-final and utterance-final).

The extent of F0 variation in both H and L tones decreases slightly as the strength of the upcoming boundary increases (refer to the ratios in Table 6.7). For example, the ratio for L tones decreases from 0.21 in phonological phrase-final position to 0.18 in utterance-final position. This suggests a slight compression of the tonal space at the end of utterances. In absolute terms there is least variation in F0 in utterance-final Lp tones. Overall, however, there is a striking constancy in the ratio of the standard deviation in F0 to the mean F0 in H and L tones in all positions in the utterance, suggesting a similar degree of variability in the scaling of both sets of tones.
<table>
<thead>
<tr>
<th>Phrase position</th>
<th>H*</th>
<th>L_p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (Hz)</td>
<td>SD (Hz)</td>
</tr>
<tr>
<td>PhonP-final</td>
<td>227</td>
<td>50</td>
</tr>
<tr>
<td>IP-final</td>
<td>223</td>
<td>46</td>
</tr>
<tr>
<td>Utt-final</td>
<td>201</td>
<td>42</td>
</tr>
</tbody>
</table>

Table 6.7: Relative variability of H* tones and L_p tones (in F0 (Hz)), by phrase position

6.7 The phonological structure and phonetic behaviour of the L_p boundary tone

In the autosegmental-metrical literature, the phonetic behaviour of boundary tones is interpreted as providing evidence for their phonological structure. The phonological structure of a boundary tone of a given type consists of (a) the points of phonological association it contracts between the autosegmental tone tier, the prosodic structure tier, and the segmental tier; and (b) the kinds of phonetic interpretation it licenses, in terms of scaling and alignment. In sections 6.3 to 6.6, I have presented qualitative and quantitative evidence for the phonological phrase boundary as the point of phonological association of a low tone. In this section, I will discuss how the phonetic behaviour of the L_p boundary tone relates to existing models of boundary tone structure within the autosegmental-metrical literature. In particular, I will discuss phonetic F0 patterns in which there is a low level stretch of F0 following the fall to the L_p tone target, and their implications for the phonological structure of the L_p boundary tone.

6.7.1 Boundary tone types in the autosegmental-metrical literature

The intonational boundary tones described to date in the autosegmental-metrical literature on stress accent languages can be broadly classified into two types, on the basis of the phonetic and phonological behaviours of the tones. The existence of both types of boundary tone was established in the earliest stages of the autosegmental-

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17 For example, in English, upstep of an H% boundary tone is triggered by an adjacent H- phrase tone.
metrical intonational phonology literature, in Bruce (1977) and Pierrehumbert (1980). They are schematically illustrated from English in Figure 6.17 (below).

The first type of boundary tone is a purely phrase-peripheral tone. The H% intonational phrase boundary tone in English is an example of this type of boundary tone. Phonologically, the peripheral boundary tone is associated to a right prosodic constituent boundary. Phonetically, the tonal movement is typically realised on the last syllable or two of the phrase. The transition to the tone target tends to occur abruptly on this syllable, though there may be a gradually rising or falling transition from a preceding tone specification. However, whether the transition is gradual or abrupt, the tone target is only reached at the very periphery of the phrase.

The second type of boundary tone, the phrase tone, also has a phonological association to the boundary of a prosodic constituent. However, the phonological structure of the tone also licenses another association link to a phonologically defined site earlier in the phrase (Grice, Ladd and Arvaniti, 2000). This enables this type of boundary tone to control the F0 of an entire preceding segment of the phrase, not only of the one or two syllables directly peripheral to the phrase edge. It is exemplified by the intermediate phrase tone in English (L- or H-):

Grice, Ladd and Arvaniti (2000) account for the leftward extent of the English intermediate phrase tone in terms of this ‘secondary association’ of the tone to the first lexically stressed syllable following the nuclear accent in the phrase. Figure 6.17 shows the secondary association as a dashed association line drawn between the tone and the nucleus of the first lexically stressed syllable in the word associations. The primary association is represented as a dashed line drawn from the L- tone to the intermediate phrase constituent boundary. If an English intermediate phrase tone is followed by an intonational phrase boundary tone, the phrase tone will extend phonetically from the first lexically stressed syllable after the nuclear accent up to the onset of the boundary tone on the final syllable of the phrase, as shown in Figure 6.17.

The secondary association line represents a second phonetic tone target of the same type and scaling as the primary target. Since the secondary association is not independently interpreted in terms of its scaling, the stretch of pitch interpolated
between the primary and secondary association points is expected to be level (monotonic). Linear interpolation between two association points with the same F0 scaling necessarily produces a level stretch of F0.

In this respect, the outcome of secondary association does not differ phonetically from tone spreading. Tone spreading does not allow for the independent phonetic interpretation of the spread tone; the segments across which tone spread occurs are all linked by association lines back to the single original tone, and the spread tone adopts the same scaling as that tone (refer to Chapter 5, section 5.5.2.1). As described in Chapter 5, the archetypal situation in which tone spreading is hypothesized is where there is little or no change in F0 level across the syllables bearing the spread tone. Tone spreading of this kind is akin in its outcome to a command ‘Continue at the same F0 level until the next tonal instruction’ (see footnote 20, this chapter).

However, there is a phonological difference between tone spreading and phonetic interpolation. The notion of secondary association assumes a determinate point of reference for the insertion of the second association line, such as a particular constituent edge, or a prosodic head in a specific location in the phrase (e.g.: “first stressed syllable after the nuclear accent”; cf. Grice, Ladd and Arvaniti, 2000). In contrast, a phonetic mechanism of tone spreading does not necessarily assume a determinate, a priori endpoint to the spreading: the endpoint can be contextually determined by the location of a following tonal event or prosodic boundary.
Grice, Ladd and Arvaniti (2000) also illustrate a somewhat different conception of the phrase accent as found in a number of Eastern European languages, in which the phrase accent occurs between the nuclear accent and the IP boundary, but does not necessarily control the pitch level throughout this region of the phrase. This type of phrase accent bears a secondary association to the first post-nuclear lexically stressed syllable, and is a punctual tone target, akin to a pitch accent, but without the prominence-lending characteristics of the latter. However, it is the earlier concept of the phrase accent as controlling pitch between the last accent and the right IP boundary or the right edge of the intermediate phrase that is relevant to the present discussion.

Another interpretation of level postnuclear stretches of F0 in Southern British English and Northern Standard German is given in Grabe (1998a). Grabe posits only two underlying pitch accent types, H*+L and L*+H, and represents IP boundaries as remaining either tonally unspecified (0%) or carrying an H% boundary tone. She reinterprets the tonal configurations described as H* L-L% and H* H-L% in the ToBI framework in terms of a bitonal accent without further IP boundary tone.
specification (denoted 0%). The transcriptions of the two tonal configurations are therefore H*+L 0% and L*+H 0%. It is not clear in Grabe’s account whether stretches of level F0 are also found after the L*+H and H*+L bitonal accents IP-medially, and if so, what limits the rightward extent of the level stretch; no illustrations are provided in which an unaccented word follows either of these bitonal accents.

Grabe describes the phonetic realisation mechanisms for the two configurations in passing, as follows (1998a:99): “‘0%’ transcribes the end of the intonation phrase and specifies an insertion point for a second phonetic target of the immediately preceding tone.” Thus, secondary association from the trailing tone of the last pitch accent (but with interpolation to the right) is the presumed mechanism. In this account, the onset of the level stretch of F0 will vary depending on the location of the bitonal accent within the accented word. In the next section I will show how this contrasts with the situation in Kuninjku, in which the onset of the level stretch of pitch is always the penultimate or final syllable of the accented word.

6.7.2 The $L_p$ boundary tone and low tone spreading in Kuninjku

There are F0 contours in Kuninjku with a phrase-final, low level stretch of F0, which appear superficially similar to contours which have been analysed in the autosegmental-metrical literature as involving a phrase tone with a primary association to the right phrase edge, and a secondary association to the first lexically stressed syllable after the final accent in the phrase (cf. Grice, Ladd and Arvaniti, 2000). In the phrase tone analysis, the level tone is said to be a consequence of a simple linear interpolation between two association points. However, I will argue against such a representation of these contours in Kuninjku, and in favour of a tone-spreading analysis18.

The phonetic behaviour of the low phonological phrase boundary tone in Kuninjku has characteristics of the behaviour of both the ‘peripheral boundary tone’ and the ‘phrase tone’ types described in the section above, as well as certain differences from both. On the one hand, the initial $L_p$ tone target aligns, without exception, with the final syllable or two of the last accented word in the phonological

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18 A possible alternative analysis to tone spreading might be a simple phonetic stipulation that the F0 should continue at the level set by the preceding tone target, until the next tonal gesture is implemented, or a blocking prosodic boundary (such as an IP boundary) is reached. A positive aspect of this analysis is that it would maintain the preference for underspecification (minimal assignment of tones to syllables) which is one of the strengths of the AM two level tone model.
phrase. That is, the low target is always aligned at the periphery of the phonological phrase constituent. On the other hand, the tone target level may extend rightwards from this point of association, across any unaccented words which follow, up to another tonal specification or an IP boundary (see Figure 6.18).

The regularity of the \( L_p \) target alignment shows that this is the primary association point of the low tone, from which point the tone may extend, a variable distance, to the right. This is in contrast with the behaviour of the phrase tone type as exemplified by English, which also has a primary association with a phrase boundary, but typically interpolates leftwards from the primary association point, towards a secondary association point soon after the nuclear accent.

As described in Chapter 5 (section 5.5), the phonetic interpolation mechanism requires two tone targets between which the F0 is interpolated. The rationale behind the notion of secondary association in relation to English is to provide a second tone target, to explain how the extension of the phrase tone is bounded to the left. I will argue that the phonetic interpolation mechanism cannot be applied to explain the low level F0 after the \( L_p \) tone in Kuninjku, because a second tone target to the right is lacking. I will present three illustrations of Kuninjku contours, and then discuss this contention.

The three contexts in which low level F0 extends across unaccented syllables to the right following an \( L_p \) tone are illustrated in Figures 6.18 to 6.21. Figures 6.18 and 6.19 illustrate the low phonological phrase tone in Kuninjku extending rightwards across an unaccented word up to an IP boundary. Figures 6.20 and 6.21 illustrate the low tone extending across unaccented syllables up to a following tonal specification, in each case a downstepped accent.
Figure 6.18: Early alignment of the phonological phrase tone with respect to the IP boundary, and subsequent tone spreading.

Figure 6.19: Continuation of the low F0 level following the Lp tone across the unaccented word kumekke (to the end of the intonational phrase).

Transcription: ben-nang kumekke
Gloss: 3/3pl-seePP NEU-ANA.IMM.
Translation: ‘He saw them there.’

Sound file 6.11

Figure 6.19 shows a steep fall to a low tone target on the final syllable of the accented word ben-nang, followed by a word-level (BI1) break, followed by an unaccented
word *kumekke*, then an IP boundary\(^{19}\). A slight downturn is evident on the last syllable of the phrase, but it is not audible as such. It may be a side-effect of the lowering of subglottal pressure utterance-finally\(^{20}\).

Figure 6.20 illustrates the continuation of the low level F0 across the final syllable *djeng* of *nga-ngadjeng*, ‘I struck it’, before a second, downstepped pitch accent on the discourse marker *wanjh*, which precedes the fall to the final low target of the phrase. Note that the ‘H’ target of the downstepped high tone is the same F0 level as the preceding ‘L’ tone (an aspect of tone scaling in BGW briefly outlined in Chapter 1, §1.7.3.1). There is no contradiction in this; rather, it illustrates how the two sequences of HL tones occupy distinct (yet related) tonal registers\(^{21}\). Within each tonal register, each H is defined as ‘high’ relative to the following L, and vice versa.

\[\text{Figure 6.20: Alignment of the low target with the right edge of the penultimate syllable (in *nga-ngadjeng*).}\]

Transcription: *nga-ngadjeng wanjh*
Gloss: 1-strikePP then.
Translation: ‘I struck it then.’

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\(^{19}\) The Strict Layer Hypothesis (Selkirk 1984) requires that the outer edges of lower-level prosodic constituents which are peripheral in a higher-level constituent coincide with the outer edges of that higher-level constituent (i.e. exhaustive embedding of lower-level in higher-level constituents). In BGW, this hypothesis is true of the foot in relation to the phonological word, and of the intonation phrase in relation to the utterance. However, it does not appear to hold true for the phonological phrase in relation to the intonation phrase. As Figure 5.10 illustrates, the edge of the Phonological Phrase coincides with the right edge of the word *ben-nang*, but the edge of the IP coincides with the right edge of the unaccented word *kumekke*.

\(^{20}\) It may also be that low tone spread across a number of syllables is more susceptible to downdrift than high spread tone, for reasons relating to articulatory differences in their production: cf. Connell and Ladd 1990, who describe a phenomenon of gradual F0 lowering across sequences of L tones in Yoruba which is absent in sequences of H or M tones, and Erickson et al. (1995) on the different laryngeal muscle sets involved in the production of L and H tones.

\(^{21}\) Pierrehumbert and Beckman (1988: 189-190) observe certain contours in Japanese in which “two accent falls are apparent, but there is no intervening rise for the accentual phrase boundary”, producing a similar effect of an L tone target merging into the H target of the following phrase.
In Figure 6.21, there is a fall to a low tone target at the right edge of the penultimate syllable of the accented word *bi-rr(u)lubom*, followed by a word-level (BI1) break, followed by an unaccented word (or proclitic) *la*, then another accented word, *djal-durndi*. The accent on *djal-durndi* is downstepped, but not as completely as in Figure 6.20 – it rises above the level of the preceding low F0. The fall to low across the syllable *lu* is quite steep, and crisply aligned with the right edge of the penultimate syllable. Following the fall, the low tone continues at the same level\(^2\) up to the following accent; I analyse this as tone spreading (the addition of an association line) across the following clitic *la*.

\[\text{Figure 6.21: Continuation of low tone across the word-final syllable -bom and unaccented la.}\]

Transcription: yimarnek bi-rrulubom la ø-djal-durndi
Gloss: CTRFAC 3/3P-spearPP and just-returnPP.
Translation: ‘He should have speared him and just come back.’

\[\text{Sound file 6.13}\]

\(^2\) There is a slight ‘hump’ on ‘bom’, however, the amplitude across this syllable is particularly low and breathy, which may have affected the pitch tracking, and the slight hump is not audible as such.
Note that the domain of the extended low tone does not correspond to any known prosodic constituent: from the final syllable of one word and across a pro-clitic to the following word. The low level F0 is phonetically bounded, to the right, by the onset of the following downstepped accent, !H*.

In relation to a contour such as the one shown in Figures 6.18/6.19, it would be possible to argue that F0 interpolates between the Lp tone and another, IP-final boundary tone, which we could call L%. However, there is no phonetic evidence to support such an analysis: empirically, as I demonstrated in section 6.4.4, there is no phonetic difference in scaling or alignment between the L boundary tone at a phonological phrase-final boundary and the L boundary tone at an intonation phrase-final boundary. Hayes and Lahiri (1991: 68) also reject a possible sequence of two L boundary tones in Bengali, partly on the basis of the lack of any phonetic evidence for the presence of two distinct tones. In relation to Kuninjku, to argue that interpolation between an Lp tone and an L% boundary accounts for the low level stretch of F0 across unaccented syllables up to an IP boundary misses the generalisation that IP-medially, the F0 after an Lp tone also continues low and level across any unaccented syllables, before the next tonal specification. For these reasons, I do not posit an additional L% tone to account for the low level stretch of F0 up to the IP boundary in contours such as shown in Figures 6.18/6.19.

One final aspect of the phonetic behaviour of Lp tones should be mentioned. In contexts of relative ‘tonal crowding’ – in which a single syllable separates the Lp tone from the following accent – the onset of the accentual rise may begin in the preaccentual syllable, immediately following the Lp tone target, before the end of the word. Figures 6.22 and 6.23 below illustrate this phenomenon of ‘anticipatory’ rise into the following accent. The arrows indicate the anticipatory rising transition from the preceding Lp target to the following H* accent.
Figure 6.22:  Anticipatory rise on syllable -meng of bene-karrmeng.

Transcription: man-korle bene-karrmeng bonj
Gloss: III-spear 3ua-takePP that’s it
Translation: ‘The two of them had spears, then they were ready.’

Sound file 6.14

Figure 6.23:  Anticipatory rise on -neng before the accented syllable ben- of ben-yakwong.

Transcription: ben-nguneng ben-yakwong
Gloss: CONJ MA:IMM.PREV. 3P/3pl.-eatPP 3P/3pl.-finishPP
Translation: And him, he ate them and finished them off.

Sound file 6.15
6.7.3 \( L_p \) deletion and ‘tonal scope’ in high level contours

As mentioned in Chapter 2, section 2.3.5, contours ending in a high boundary generally show no phonetic reflex of any phonological phrase low boundary tones within the intonation phrase or utterance. There is neither any direct reflex, in the form of a low target, nor any indirect reflex, such as downstep on an adjacent high tone (see Figure 6.24). This raises the question of how to analyse the absence of the \( L_p \) tones within these high level phrases. In some cases, a high level intonation phrase or utterance will comprise a number of phonological words. In the context of an intonation phrase or utterance ending in a low boundary, each phonological word would typically end in a phonological phrase \( L_p \) boundary tone, unless prosodically integrated with another word.

![Figure 6.24: High tone spread between initial accent target and end of IP/utterance.](image)

Transcription: ka-m-kuyin-wam kondanj darnkiih
Gloss: 3-hither-almost-goPP here close
Translation: ‘He approached closely, he almost came here.’

Sound file 6.16

In fact, there are a few exceptional contours in which an \( L_p \) tone does surface within an intonation phrase ending in high level F0, which provide a clue to the analysis of these contours. In the utterances shown in Figures 6.25 and 6.26 below, there is a phonological phrase ending in an \( L_p \) tone within an intonation phrase ending in high level F0. In Figure 6.25, for example, the degree of juncture following kurrmeng or yiman is not sufficient for an intonation phrase break. In particular, the accentual rise
on the syllable *ku of *kuni does not sound like a resetting of pitch level (when compared with unambiguous resets). This means, then, that it is possible for an L\textsubscript{p} tone to surface within an IP constituent ending in high level F0. In Figure 6.26, the L\textsubscript{p} tone is followed by a downstepped !H* accent in the following phonological phrase.

The important piece of evidence is that in neither example does the L\textsubscript{p} tone appear to be associated with a full intonation phrase boundary, but only a phonological phrase juncture.

Since it is possible for an L\textsubscript{p} tone to surface within an intonation phrase which ends in high level tone, examples such as Figures 6.25 and 6.26 argue against using a ‘global register raising’ rule, with the intonation phrase as its domain, to account for those IPs with high level F0 across one or more phonological phrases (as in Laughren (1983)’s account of high level intonation in interrogative phrases in Zulu). Here I will argue for an analysis in which the phonological phrase-delimitative L\textsubscript{p} tones are deleted if they fall within the ‘scope’ of certain pragmatic meanings associated with high level contours. These meanings include topicalization and conjunction/incomplete list or sequence, e.g. of actions (refer to Chapter 2, §2.3.5.3).

A concept of ‘tonal scope’, relating the scope of a semantic or pragmatic meaning to a tone association rule, is proposed in Hyman (1990). Hyman refers to a rule of boundary tone association in Kinande\textsuperscript{23} which he describes as being conditioned by tonal scope (1990: 121). This rule affects the surface appearance of a postlexical high boundary tone, H\textsubscript{\%}, which regularly occurs on a toneless mora at the end of a phonological phrase constituent, where it precedes any intonational boundary tone. In the context of an imperative utterance, in IP-final position, H\textsubscript{\%} is deleted or de-linked. There are a couple of very interesting aspects to this ‘context’, which is only partly phonological (it is phonological insofar as it makes reference to the edge of an IP). The rule suspending H\textsubscript{\%} can apply across a sequence of more than one intonation phrase, but only if the phrases are interpreted as constituting a single imperative utterance (1990:121). Each phrase is affected by H\textsubscript{\%} delinking, even when the imperative is not syntactically encoded in each. Therefore, the rule does not depend on a direct syntactic encoding of imperative mood, but it does depend on the pragmatic ‘scope’ of the imperative meaning. Moreover, a syntactically imperative utterance used with the force of a *suggestion will allow the H\textsubscript{\%} tone to surface, in the

\textsuperscript{23} A Bantu language of Eastern Zaire (Hyman, 1990: 112)
same manner as a syntactically non-imperative utterance (1990:119). Therefore, the boundary tone deletion rule is clearly pragmatically conditioned. On the representation of this deletion process, Hyman comments (1990: 120):

Our account requires that we either keep the $H_H$ from being assigned or that we have a later rule removing $H_H$ in the proper imperative forms. I will adopt the latter approach and propose that the $H_H$ of an imperative PP is deleted when the PP stands at the end of an IP (e.g. before pause).

In Figure 6.25, the scope of high level intonation is restricted to the locative demonstrative, *kuni*. The context of the utterance is the speaker describing how the two protagonists (in the BILLABONG text) break open a honeybee hive and take out the honey, putting it in a container or on the ground (*kurrmeng*). The low phonological phrase tone after *kurrmeng* gives that word the force of an assertion, which the word would appear to lack if it ended in high tone. The high level tone on the demonstrative *kuni* adds the implication that putting the honey down is one action in a sequence (beginning with breaking open the hive), and not the final action — an implication which is immediately reinforced by the following phrases, *wanjh bonj*, *bene-baruy*, ‘that’s it then, they covered it’ (meaning, in the context, they covered a brush with honey). Both of these phrases end in a low boundary, which, in addition to the discourse interjection *bonj*, indicates an end to the sequence of actions.

In Figure 6.26, the scope of high level intonation again conveys a subtle shade of meaning. The high level intonation here also carries the meaning ‘this action (and therefore, by implication, the speech turn describing it) is ongoing, incomplete’, and the scope of the high level intonation across the words in the phrase reflects the scope of the action itself. If the whole phrase were under the scope of high level intonation, it would suggest that the ongoing action was one of ‘eating bush passionfruit’. With the word ‘bush passionfruit’ left out of the scope of the high level intonation, the ongoing action is simply one of eating, with bush passionfruit being only one of a number of foods consumed. In this example, the use of the immediate prefix -h- on the verb also serves to reinforce the ‘immediacy’ of the action associated with progressive aspect (cf. Evans, in press: §11.4.3).

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24 In this use of high level F0 for a “continuative”-type utterance, BGW aligns with many other (particularly Indo-European) languages (cf. Hirst and di Cristo, 1998: 27).
Figure 6.25: $L_p$ tone target (located at the arrow) medial in an IP ending in high level F0.

Transcription: kurrmeng yiman kunih
Gloss: 3P-put.downPP like LOC.DEM.
Translation: He put it down, like here –

**Sound file 6.17**

![Sound file 6.17](image)

Figure 6.26: $L_p$ tone target (located at the arrow) medial in an IP ending in high level F0.

Transcription: djalamardawk bene-h-nguneng
Gloss: bush.passionfruit 3ua-IMM-eatPP.
Translation: They ate bush passionfruit…

**Sound file 6.18**

![Sound file 6.18](image)
The deletion of $L_p$ tones in the Kuninjku utterance illustrated in Figure 6.24, *ka-m-kuyin-wam kondanj darnkih*, can be represented as in Figure 6.27 below. My analysis of the meanings associated with the H% boundary tone (as described in Chapter 2, §2.3.5.3) suggests that $L_p$ tones are de-associated (or deleted) within a domain which varies in size according to the intended scope of the semantic (aspectual) or pragmatic meaning associated with high level intonation. Note that there is no necessary implication that the phonological phrase *boundaries* are deleted, but only their demarcative tones. There is no evidence that the rule is more than a simple tone deletion rule affecting the surface tonal representation of a phrase.

![Prosodic Hierarchy Diagram](https://example.com/prosodic_hierarchy.png)

**Figure 6.27:** Representation of $L_p$ deletion in a high level contour ending in H%
6.8 Conclusion

In this chapter I have presented phonetic and phonological evidence distinguishing four levels of prosodic constituent in the Kuninjku dialect of BGW: the phonological word, the phonological phrase, the intonation phrase and the utterance. The primary focus of the chapter has been to establish the existence of the phonological phrase in Kuninjku, and to describe the phonetic behaviour and phonological structure of the low phonological phrase boundary tone, Lp.

The experimental phonetic findings of this chapter (sections 6.3 to 6.6) can be summarised as follows:

1. Low phonological phrase tones (Lp) in PhonP-final and IP-final positions are similarly scaled;
2. Lp tones utterance-finally are scaled distinctly lower, on average, than PhonP-final or IP-final Lp tones;
3. Lp tones are scaled in relation to the F0 height of the preceding H* peak within the phonological phrase. The height of the peak is predictive of between 26% (in utterance-final position) and 57-58% (in PhonP-final and IP-final positions) of the variation in the target F0 of the Lp tone;
4. Lp tones in all phrase positions align with the penultimate or final syllable of the phonological phrase;
5. Lp tones tend to occur earlier (i.e. are more frequently aligned with the penultimate syllable) when the preceding accentual peak is further from the edge of the phonological phrase, and when the phrase is utterance-final. However, the Lp tone is not tightly temporally bound to the preceding peak. This is evident in the fact that the Lp tone never occurs earlier than the penultimate syllable, even when the accented syllable is three to four syllables from the right word edge.

Given that scaling and alignment are the two principal parameters of tonal realisation, the virtually identical phonetic behaviour of PhonP-final and IP-final Lp tones in relation to both parameters points to the conclusion that underlyingly, the L boundary tone in PhonP-final and IP-final positions is phonologically the same boundary tone (Lp). If the L tone associated with the end of accented words in phonological phrase-final position is the same as the L tone which appears IP-finally, then that L tone should also be present at the next highest level in the hierarchy, the utterance. This
follows from the nature of the prosodic hierarchy itself: prosodic features which appear at lower levels of the hierarchy ‘percolate’ up to or persist at higher levels, often with additional features added by the higher level. There is no evidence for an additional boundary tone added at the utterance boundary. However, utterance-final $L_p$ tones are subject to a particular scaling effect, i.e., final lowering, to which the PhonP-final and IP-final $L_p$ tones are not subject.

These phonetic findings distinguish the utterance level from the intonation phrase and phonological phrase levels. The latter two levels are distinguished by the fact that relative prominence relations are contracted between accents in adjacent phonological phrases, within a single intonation phrase. The phonological phrase is distinguished from the phonological word in two ways: by the possibility of two phonological words occurring in a single phonological phrase as diagnosed by the presence of a single $L_p$ tone, and by patterns of accent assignment to peripheral feet within the phonological word, which are preserved when two words form a single phonological phrase.

Until quite recently, the literature on phonological phrasing has been predominantly phonological, and typically oriented towards modelling the relationship between syntax and phonology, mostly in analytic languages. There are few studies as yet of phonological phrasing in languages with complex morphosyntactic structure, including processes of lexical incorporation. This, and the following chapter on the lexical content of phonological phrases in Kuninjku, are intended to contribute to the literature on phonological phrasing in polysynthetic languages.

In terms of the autosegmental-metrical literature on intonation, the Kuninjku phonological phrase can be seen to share certain of the characteristics of the ‘intermediate phrase’ in English, as defined in Beckman and Pierrehumbert (1986). The phonological phrase in Kuninjku, like the English intermediate phrase, is the minimal tonally demarcated unit (see Chapter 7, section 7.2.3.2). However, the English intermediate phrase is the unit within which relative prominence relationships between accents are defined (Beckman and Pierrehumbert 1986: 298). Such relations are defined between phonological phrases in Kuninjku (section 6.3.4). The phonological phrase in Kuninjku corresponds more closely in this respect to the accentual phrase in Japanese, a unit which is tonally demarcated by a phrasal H tone attaching to the second sonorant mora of the accentual phrase, and an L boundary
tone which falls at the right edge of the phrase. The Japanese accentual phrase, like
the Kuninjku phonological phrase, is the minimal tonally demarcated unit, and
relative prominence relations (catathesis, or downstep) are defined between accentual
phrases, within a unit Beckman and Pierrehumbert refer to as the ‘intermediate
phrase’.

Phonological phrasing in Kuninjku is not generally subject to a complex set of
syntactic and pragmatic determinants; the phonological phrase is most frequently
isomorphic with the phonological word. The relatively marked circumstances in
which two phonological words integrate to form a single phonological phrase are
discussed in the following chapter. Phonological phrasing in Kuninjku also does not
appear to be affected by focus, as it is in a number of diverse languages, including
Korean (Jun, 1996; Cho, 1990) and Chichewa (Kanerva, 1990). Rather, as described
in Chapter 3, information focus and contrastive focus are associated with a
manipulation of accent height (increased accentual prominence) within the
phonological phrase, relative to the height of accents in adjacent phonological phrases
within the intonation phrase.
Chapter 7

Phonological phrasing and prosodic integration

7.1 Introduction and overview

In this chapter, I examine the lexical content of phonological phrases, focusing on the contexts in which, contrary to the general pattern of isomorphic mapping, two accented phonological words are integrated into a single phonological phrase. The phrasing of unaccented words is distinct from that of accented words, and is discussed at the end of the chapter.

The outline of the chapter is as follows. In section 7.2, I briefly outline the literature on the concept of prosodic integration. In section 7.3.1, I examine the frequencies with which each lexical class in Kuninjku is phrased in a separate, or a prosodically integrated, phonological phrase. As discussed in Chapter 6, a low edge tone, Lp, generally demarcates the right edge of the phonological phrase in Kuninjku, and a phonological phrase demarcated by Lp at its right edge typically contains a single phonological word (see Table 7.1 in section 7.3.1 below). Prosodic integration is therefore diagnosed by the absence of an Lp tone after the first word in a sequence of two phonological words, where the second word ends in a fall to the Lp tone.

The absence of the Lp tone at the end of the first word results in the F0 trace remaining phonetically high and level at the end of this word. Auditorily, the two words sound as though they fall under a single contour. As mentioned in the conclusion to Chapter 6, I define the contour ending in the Lp tone as the minimal contour which can be described as a “single (or separate) intonation contour” in Kuninjku (see also section 7.3.2.2). This is an important clarification of the latter phrase, since it tends to be used quite loosely in the syntactic literature, without clear reference to a particular level of prosodic constituent. This clarification should enable an accurate mapping, in future work, between intonational and grammatical constituency in Kuninjku.

In sections 7.2 to 7.4, I describe in more detail the phonological phrasing of verbal, nominal, and other lexical classes in two Kuninjku texts, BILLABONG and
CUCKOO. In section 7.4, I describe the phrasing of unaccented words. Section 7.5 summarises and concludes the chapter.

7.2 The concept of prosodic integration

The term ‘prosodic integration’ is sometimes used to describe processes of cliticisation to phonological words (e.g. Booij, 1996). Elsewhere, the term is employed to describe the integration of words into a single, intonationally demarcated unit (Sánchez, 2001; Evans, in press).

Diagnostics for prosodic integration between phonological words and clitics typically include resyllabification (the phonological word plus clitic form a new domain for syllabification), absence of word stress in the clitic (a single word stress is assigned to the unit comprising the phonological word plus the clitic), and the application of phonological-word-internal phonotactics within the new unit (Booij, 1996). These diagnostics have in common that a new, larger unit is formed to which processes definitive of the phonological word apply. Here I adopt the view, following Booij (1996) and others, and contra Nespor and Vogel (1986), that the phonological word plus clitic sequence forms a larger phonological word domain, and not a different prosodic domain, such as a ‘clitic group’.

Similarly, prosodic integration at higher phrase levels can be defined in terms of the application of tonal diagnostics of prosodic constituency to an enlarged uni, such as the presence or absence of phrase-demarcative tones (Sánchez, 2001; see also Jun, 1996 in relation to ‘dephrasing’ in Korean).

Sánchez (2001) examines the frequency of prosodic integration in Spanish complementation constructions. Using the diagnostics of intonation units provided in Chafe (1987: 22) and Du Bois et al. (1991, 1993), Sánchez defines prosodic integration in complementation constructions as the occurrence of “both the matrix and the complement clauses… in the same intonation unit.” (2001: 205). Sánchez finds that two factors affect the phrasing of complement constructions: the degree of ‘semantic integration’ between the clauses, defined as “correspondences or relations of semantic identity between the clauses, defined as “correspondences or relations of semantic identity between

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1 In a stress accent language, a primary word stress will often carry a pitch accent; the clitic will therefore either be unaccented or carry the primary accent for the new, enlarged domain.
subcomponents of the two constructions” (2001:203), and the status of information in each clause: in particular, the activation state and recoverability of new referents.

Sánchez illustrates the correlation between the degree of semantic integration and the presence or absence of prosodic integration with the following two examples, both from conversational texts (2001: 203). In these examples, \ indicates an intonation phrase-final falling boundary, / a phrase-final rising boundary, and ^ the location of phrasal stress.

(1)

OSCAR: …El sábado pa ^sado/?

last Saturday

→ …Pues yo creo que ^fui\.

I think I went.

(2)

OSCAR: … Yo ^creo/,

→ I think

que le ha `creado un ^trauma\,

→ that he’s been traumatized by it.

In (1), the matrix clause yo creo, ‘I think’, is phrased together with the complement fui, ‘I went’ (preceded by the complementiser que) in a single IP. The two verbs share a first person subject, which is equi-deleted in the complement clause. The new information conveyed by the complement is minimal: the referent, being the speaker, is fully recoverable. In contrast, in (2), the separate IP phrasing of the matrix and complement clauses reflects both the distinct subject pronouns of each clause, and the significant amount of new information conveyed by the complement clause, even though the subject of the clause is assumed to be recoverable, as indicated by the use of the pronominal le.
According to Sánchez, the information status of referents in the discourse context tends to override semantic integration (such as identity of pronominal referents in the matrix and complement clauses) as a determinant of prosodic constituency (2001: 212). However, there is also “a tendency for complementation constructions to be encoded prosodically integrated in general” [sic], and morphosyntactically integrated clauses “occur prosodically integrated most of the time” (2001: 207).

Some recent research into the correspondence between grammatical and prosodic constituency gives considerable prominence to prosodic constituency, at the level of intonation units, as a significant determinant of grammatical interpretation (Sánchez (2001); Tao (1996); Steedman (2000, 1993, 1991); Merlan (1994: Chapter 10). In the absence of morphosyntactic means of encoding constituency, similar lexical strings of words may project different constituency relationships, depending on their grouping into intonationally demarcated phrases.

In Tao (1996) and Sánchez (2001), distinct intonation units are defined by a combination of contour shape, pause distribution, final lengthening, anacrusis and pitch reset distribution (Tao (1996: 32-54); Sánchez (2001: 205)). However, neither study gives attention to the level of the prosodic hierarchy to which the units thus defined might correspond. Tao (1996: 35) asserts that “[t]he most important criterion for judging intonation unit boundaries is that of a unified intonation contour: a string of words must be conceived as falling under a single unified intonation contour.” In section 7.3.2.2, I argue that the minimal intonationally demarcated unit, or “unified intonation contour” in Kuninjku is the phonological phrase, rather than the intonation phrase, as in Spanish (Sánchez, 2001) and Chinese (Tao, 1996), or the intermediate phrase in English (Beckman and Pierrehumbert, 1986).

The interaction between grammatical and prosodic constituency is of particular interest in relation to the so-called non-configurational languages, such as BGW (Evans, in press), and Wardaman, another language of the Northern Territory (Merlan, 1994). Since morphosyntactic marking of constituency relations in BGW is minimal (Evans, in press: §6.1), it is likely that prosodic phrasing makes a significant contribution to the interpretation of grammatical constituency. As described in Chapter 1, one of the aims of this thesis is to lay the groundwork, in terms of intonational description, for a study of the
mapping between grammatical and prosodic constituency in discourse, in Kuninjku and the more closely related dialects (such as Kunwinjku). Further work remains to be done on the intonational description of the Mayali and Gun-djeihmi dialects. The following sections make an initial venture into the study of this mapping, examining the phonological phrasing of lexical items in two Kuninjku narratives, BILLABONG and CUCKOO.

7.3 Phonological phrasing and prosodic integration in Kuninjku

7.3.1 Frequency of prosodic integration by lexical class

As mentioned in section 6.2.2, certain lexical classes in Kuninjku show a stronger tendency than others to prosodically integrate in a single phonological phrase with another word. These classes are demonstratives, adverbs, and independent pronominals. In addition, sequences of verbs which are semantically highly integrated appear to favour prosodic integration (see section 7.3.2).

An analysis of the BILLABONG and CUCKOO narratives (Kuninjku dialect) provided the following breakdown of phonological phrasing by lexical class (Table 7.1). In this table, data from both texts is combined.

A Chi-square test was applied to the counts of words from five lexical classes, with regard to the frequency with which words from these classes form separate vs integrated phonological phrases. The classes were chosen on the basis of having sufficient (>5) tokens in the relevant cells to apply the Chi-square statistic without the need for a correction. For cells with less than 5 tokens, Yates’ correction is generally applied to protect against false rejection of the null hypothesis. The selected classes were: verbs, independent nominals, independent pronominals, demonstratives and adverbs (including the locative adverb kure, ‘there’).

The results confirm that there are significant differences in the frequency of separate phrasing vs prosodic integration among these lexical classes. With 5 degrees of freedom (df = 5), the value of $\chi^2$ must be greater than or equal to 18.47 for the $\chi^2$ result to

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2 When both words are accented.

3 This is a partly similar list to the classes of word which behave as clitics to the phonological word in Lushootseed (deictic marker, adverb, pronoun, preposition, interjection) (Beck, 1999; Chapter 5, section 5.2.2.3).
be significant at the level of p < 0.001. The value of $\chi^2$ for the present data is 38.10. The value of $\chi^2$ comprises the sum of the squares of the observed frequency minus the expected frequency of each category cell, divided by the expected frequency. This means that the observed cell values which deviate most from the expected frequency, contribute most to the numerical value of $\chi^2$. In the case of the five lexical classes examined, the cells which had the highest numerical values were the verbs, demonstratives, independent pronominals and adverbs, in the ‘prosodic integration’ column in each case. This means that each of these classes showed a stronger than expected tendency to prosodically integrate with the following word. The impressionistically observed tendency for demonstratives, adverbs and independent pronominals to prosodically integrate with a following word is also statistically confirmed by this result.

Table 7.1 also indicates that only 2% (16 out of 787) of the tabulated words occurring in phrases ending in a low boundary are unaccented; all bar one are demonstratives. This high rate of accentuation reflects the absence of deaccentuation as a pragmatic device in Kuninjku, and in Bininj Gun-wok generally.

7.3.2 Phonological phrasing of verbal words

7.3.2.1 Prosodic integration of verbal words

We have seen that verbs undergo prosodic integration relatively frequently among the lexical classes. However, the great majority of verbs do not prosodically integrate: 347 out of 358 or 97% of verbs in phrases ending in a low boundary form a separate phonological phrase. Where a verb prosodically integrates with another word, it is generally a word from one of the minor lexical classes – a demonstrative, adverb, independent or relative pronoun – which usually precedes the verb within the phrase.
Table 7.1: Phonological phrasing by lexical class: BILLABONG and CUCKOO texts (Kuninjku)

One of the contexts in which a verbal word may be followed by another verbal word within the same phonological phrase, is when the two verbs are semantically closely

<table>
<thead>
<tr>
<th>Lexical Class</th>
<th>Total number of words</th>
<th>Separate PhonPhrase</th>
<th>Integrated PhonPhrase</th>
<th>H% phrase (Lp tone(s) de-associated)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of tokens (% of total)</td>
<td>No. of tokens (% of total)</td>
<td>No. of tokens (% of total)</td>
<td></td>
</tr>
<tr>
<td>Verbs</td>
<td>448</td>
<td>347 (78)</td>
<td>11&lt;sup&gt;4&lt;/sup&gt; (2)</td>
<td>90 (20)</td>
</tr>
<tr>
<td>Independent nominals</td>
<td>160</td>
<td>141 (88)</td>
<td>4&lt;sup&gt;5&lt;/sup&gt; (2.5)</td>
<td>15 (9.5)</td>
</tr>
<tr>
<td>Demonstratives&lt;sup&gt;6&lt;/sup&gt;</td>
<td>72</td>
<td>41 (57)</td>
<td>8 (11)</td>
<td>8 (11)</td>
</tr>
<tr>
<td>Independent pronominals (excl. possessive pronouns)</td>
<td>33</td>
<td>25 (76)</td>
<td>6 (15)</td>
<td>2 (9)</td>
</tr>
<tr>
<td>Possessive pronouns&lt;sup&gt;7&lt;/sup&gt;</td>
<td>6</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Possessive adjectives</td>
<td>14</td>
<td>12</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Predicate adjectives</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Relative pronoun &lt;i&gt;kure&lt;/i&gt;</td>
<td>6</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Locative adverb &lt;i&gt;kure&lt;/i&gt;</td>
<td>14&lt;sup&gt;8&lt;/sup&gt;</td>
<td>9</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Other adverbs&lt;sup&gt;9&lt;/sup&gt;</td>
<td>32</td>
<td>25</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Totals</td>
<td>787</td>
<td>611 (78)</td>
<td>40 (5)</td>
<td>120 (15)</td>
</tr>
</tbody>
</table>

<sup>4</sup>The tokens are: <i>bi-bom wanjh</i>, where <i>wanjh</i> is accented and not enclitised; <i>nga-re nga-mang; ngerri-na bonj</i>, where <i>bonj</i> is accented and not enclitised; <i>kam-dah-durndi bi-yawan</i>; <i>kabi-we kun-mo</i>; <i>kabi-we “yi-mo-mang”</i>; <i>dololhmeng kure=nuk</i>; <i>bene-yoy dja bolk-nang</i>; <i>benenh-djaldidjaldi wanjh</i> where <i>wanjh</i> is accented and not enclitised; <i>yi-m-ray ngundi-won</i>; <i>djal-man.kang kak-yoy</i> and <i>man-bunbarr me;:y=rowk</i>.

<sup>5</sup>The tokens are <i>man-bunbarr me;:y=rowk</i>; <i>kun-red djarre</i>; <i>borndok bonj</i>, where <i>bonj</i> is accented and not enclitised, and <i>kabi-we kun-mo</i>.

<sup>6</sup>Unaccented demonstratives are included in the total count but are otherwise omitted from this table. The demonstratives recorded in these texts do not constitute the full set of demonstratives used in this dialect.

<sup>7</sup>I draw a distinction between possessive pronouns and a possessive adjectives in this table, even though the words which fulfil the two functions are homophonous, in order to assess whether there are any differences in phonological phrasing between the two. The functional distinction is that the former, but not the latter, are used in the absence of an overt nominal. However, there do not appear to be any such differences in phrasing.

<sup>8</sup>Includes one unaccented token.

<sup>9</sup>These adverbs were tokens of <i>konda</i>, ‘here’; <i>korroko</i>, ‘already’, <i>rawoyh-no</i>, ‘again’ and <i>malamalayi</i>, ‘tomorrow’.

395
integrated. As mentioned in section 7.2, the notion of semantic integration\(^\text{10}\) is due to Sánchez (2001), who in turn derives the definition from Givón (1990), among others. For complementation constructions, Sánchez provides the following measures of semantic integration (2001: 205):

- One or more of the arguments of both the matrix and the complement verbs have the same discourse referent.
- Both verbs refer to the same token of a state or event.

In the Kuninjku narratives, almost all the examples of prosodic integration of two verbal words involve the same grammatical subject in both verbs\(^\text{11}\). The exceptions are discussed below. All examples of integration involve tightly coordinated actions which effectively form a single event, though none are complement constructions. See section 7.3.2.2 below in relation to the phrasing of perception verb complements in Kuninjku.

In most of the Kuninjku examples of prosodically integrated verbs, one of the verbs is a verb of motion\(^\text{12}\). The examples include single-referent purposive sequences, as in Figure 7.1: *nga-re nga-mang*, ‘I’ll go and get it’, and Figure 7.2: *ka-m-durh-durndi bi-yawam*, ‘he came back this way in order to look for him’. Note that there is no morphological marking of the purposive nature of the sequences in these two examples: the two verbs are simply juxtaposed.

\(^{10}\) A more apt term might be ‘pragmatic integration’, given that the measures Sánchez uses make reference to continuity or coherence of discourse context, rather than a purely semantic continuity; however, for ease of reference, I will retain Sánchez’s term.

\(^{11}\) There are no examples in the corpus in which the grammatical object is the same in both clauses, but the subject is different, or in which both the grammatical subject and object are the same across the clauses.

\(^{12}\) There is also a Manyallaluk Mayali example of integration involving an associated motion construction: *barri-re barri-birndulhmi*, ‘they went along striking the water’.
Figure 7.1: Integration of two verbs into a single phonological phrase in a purposive construction.

Transcription: nga-re nga-mang
Gloss: 1-goNP 1/3-getNP
Translation: ‘I’ll go and get it’.

Sound file 7.1

Figure 7.2: Integration of two verbs into a single phonological phrase in a purposive construction.

Transcription: ka-m-durh-durndi bi-yawam
Gloss: 3-hither-REDUP-return.PI 3/3hP-look.for.PP
Translation: ‘He came/was coming back this way to look for him’

Sound file 7.2
Figure 7.3 is an example of integration in which the second verb is a secondary predicate to the first: *djal-man.kang kuk-yoy*, ‘he just fell down dead’. *Kuk-yoy*, a verb which glosses as ‘body-liePP’, means ‘dead’ when used as a secondary predicate. In this example, Sánchez’s conditions for semantic integration are fulfilled *a fortiori*: the same discourse referent is the grammatical subject in each case (each verb carries a zero prefix, indicating a third person singular, past tense subject), and the coordinated verbs refer to a single event. The observed contour also concurs with Evans’ observation that auditorily, secondary predicate constructions in BGW are characterised by “the joining of the elements under one intonational contour”. (Evans, in press: §13.4.4)

In another example (Figure 7.4), the grammatical subject changes from singular *you* to plural *they*¹³, but the discourse focus remains the referent addressed as *you*, the recipient of food which is being offered: *yi-m-ray ngundi-won*, ‘Come here and they will give it to you’. This suggests that it may be the continuity of discourse referent, rather than a more purely grammatical continuity, which is relevant to prosodic integration in Kuninjku, as in Spanish (Sánchez, 2001).

Finally, there is an example of integration in which the grammatical subject changes (from *the two of them* to *he*), and in which the two discourse referents appear to be equally foregrounded: *bene-yoy dja=bolk-nang*, ‘the two of them lay low as he looked around the place’ (Figure 7.5). *Dja* is a conjunction which generally means ‘and’ or ‘but’; however, here the meaning ‘and’ seems better translated by ‘as’ to convey the temporal overlap of the two events. The explanation for prosodic integration in this case may lie in the event dimension of the two acts, which can be construed within the discourse context as referring to two facets of the same event: a ‘hiding and seeking’ event. That is, it may be that the narrator in this case chose to prosodically integrate the verbs in order to emphasise the temporal co-occurrence of the two events.

In all of these examples, the accent on the second verb is upstepped relative to the accent on the first and is therefore more prosodically prominent than the accent on the first verb (cf. Chapter 3, section 3.12). Since all of the examples of two integrated verbs involve a second upstepped accent, it is not clear whether the stronger prominence on the

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¹³ ‘You’ is an indirect object in the second clause, indexed in the portmanteau prefix *ngundi*, which codes a third person augmented subject affecting a second person (direct or indirect) object.
second reflects the relative discourse salience of the final verb in each phrase (the purpose or outcome of the action or event in Figures 7.3 - 7.6), or whether this pattern of accent + upstepped accent in a single phonological phrase is a specific intonational construction type. A study of relative prominence relationships between accents in different types of grammatical construction in BGW would undoubtedly prove rewarding.

![Image of Figure 7.3: Integration of two verbs into a single phonological phrase in a secondary predicate construction.]

Transcription: ø-djal-man.kang ø-kuk-yoy wanjh
Gloss: 3P-just-fallPP 3P-body-liePP then.
Translation: 'He just fell down dead'.

**Sound file 7.3**

```
H*  ^H*  Lp  !H*  Lp-%
|    |    |    |    |
| djal-man.kang | kuk-yoy' | wanjh' |
```
Figure 7.4: Integration of two coordinated verbs into a single phonological phrase.
Transcription: ø-djal-man.kang ø-kuk-yoy wanjh
Gloss: 2-hither-goIMPER 3a/2-giveNP
Translation: ‘Come here and they’ll give you [food]’.

**Sound file 7.4**

Figure 7.5: Integration of two coordinated verbs into a single phonological phrase. Note that the final Lp-H% rise is audible, but is obscured by perturbation in the F0 trace at the end of bolk-nang.
Transcription: bene-yoy dja= ø-bolk-nang
Gloss: 3uaP-liePP CONJ=3P-place-seePP
Translation: ‘The two of them lay low as he looked about the place’.

**Sound file 7.5**
7.3.2.2 Phonological phrasing of perception verbs and their complements

The phonological phrasing of perception verbs and their complements provides an interesting counterpoint to the phrasing of non-complement verb sequences described in section 7.3.2.1. In BGW, the complement relationship between a perception verb and its complement is frequently signalled by relative tense on the two verbs (Evans, in press: §14.2.2). Relative tense means that where the perception verb is in the past tense, the perceived event will be coded as non-past. As Evans explains, “the non-past is used because the perceived event is non-past relative to the perceiving event” (§14.2.2).

The use of relative tense with perception verb complements could be taken as an index of the ‘syntactic integration’ (Givón, 1990: 516) of the two verbs, compared with which the verb sequences described above show no indications of syntactic integration. For example, the purposive constructions in Figures 7.1 and 7.2 are not morphologically marked as such; there is no morphological indication of the semantic dependency between the two verbs. In Givón’s formulation (1990: 516), “[t]he stronger the semantic bond is between the two events, the more intimately is the syntactic integration of the two propositions into a single clause”. Thus one might expect, in accord with their syntactic integration, at least as high a degree of prosodic integration between perception verbs and their complements as holds between the subordinate and coordinate verb sequences described above. However, in all of the available examples, the perception verb and its complement are phrased in separate phonological phrases. Interestingly, this is in accord with Givón’s further observation that “[c]omplements of cognition-utterance verbs, at the lower end of the clause-integration scale, tend to carry separate intonation contours” (1990:825). He defines “cognition-utterance verbs” as inclusive of perception verbs, as follows (1990: 518):

---

14 Such indices of syntactic integration are rare in BGW.
• The main clause contains a verb of perception, cognition, mental attitude or verbal utterance.
• The complement clause codes a proposition that in turn represents a state or event that is the object of the mental or verbal activity coded by the main verb.
• No coreference restrictions hold between arguments of the main and subordinate clauses.

In Kuninjku, then, the *phonological phrase* corresponds to the “separate intonation contour” described by Givón. This is an important clarification, since the expression ‘separate (or single) intonation contour’ tends to be used with considerable empirical vagueness in the syntactic literature. In Kuninjku, at least, a ‘separate intonation contour’ may correspond to a number of prosodic constituents: minimally the phonological phrase, but potentially an intonation phrase, or an utterance.

The semantics of the perception verb mean that the grammatical subjects of the matrix verb (the perceiver) and its complement (the perceived) are often distinct, which may be one contributing factor in their separate phrasing. While the perceiving and perceived events described by the two verbs are linked in the act of perception, they are also significantly more semantically independent events than those described in the utterances illustrated in Figures 7.1 to 7.5 above.

Figures 7.6 to 7.10 illustrate the phrasing of perception verbs and their complements. Figures 7.6 and 7.7 show uses of the perception verb ‘see’ with a complement, with relative tense on the two verbs indicating the complementation relationship between the verbs: past tense on the matrix verb and present tense on the complement. The juncture between the verbs is a phonological phrase-level break (B11) in Figure 7.6, and an IP-level juncture (B13) in Figure 7.7. In Figure 7.8, the perception verb is ‘hear’. A similar pattern of relative tense on the two verbs, and a minimal phonological phrase level juncture between them, is observed.
Figure 7.6: Separate phonological phrasing of a perception verb, *bene-nang*, and its complement, *ka-m-djal-re*.

Transcription: *wanjh bene-nang ka-m-djal-re*
Gloss: then 3uaP-seePP 3-hither-just-goNP
Translation: ‘Then the two of them saw him just coming along towards them’.

Sound file 7.6

Figure 7.7: Separate phonological phrasing of a perception verb, *ø-nang*, and its complement, *kabirri-yi-yo* (reduced to *[ga:]i]*15).

Transcription: *wanjh nungka ka-m-durh-durndi ø-nang kabirri-yi-yo*
Gloss: then he 3-hither-REDUP-returnPP 3P-seePP 3a-COM-lie.downNP
Translation: ‘Then he returned, and saw that they were lying down together’.

---

15 This reduction of the second syllable, incidentally, indicates that the initial syllable is the metrically strong syllable, despite the late peak on the second syllable (i.e. on *[ø]*).
In Figure 7.9, the perception verb is ‘see’ again, but the speaker uses absolute tense in this instance. In this example, the juncture is also phonological phrase-level (BI1).

Figure 7.10 illustrates further how little effect the syntactic complementation relationship between two perception verbs has on the degree of prosodic integration of the verbs, even when the relationship is morphologically indicated by relative tense. In this example, the perception verb birri-nang, ‘they saw him’, is separated from the perceived event ka-m-bebme, ‘he appears (coming this way)’ by a demonstrative, nani, ‘that one (masc.)’.

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16 Plural subject marking is generally not used for lower animate and inanimate subjects in Kuninjku.

17 Evans (in press: §14.2.2) cites another example in which absolute tense is used with a perception verb instead of relative tense; both uses of tense are equally grammatical.
Figure 7.9: Separate phonological phrasing of a perception verb, *bene-nah-nang*, and its complement, *ben-bom*.

Transcription: bene-nah-nang ben-bom

Gloss: 3aP-REDUP-seePP 3/3plP-killPP

Translation: ‘The two of them watched him kill [the others]’.

**Sound file 7.9**

![Waveform diagram for Figure 7.9](image)

Figure 7.10: Separate phonological phrasing of a perception verb, *birri-nang*, and its complement, *ka-m-bebme*, with a demonstrative also separating the verbs.

Transcription: birri-nang nani ka-m-bebme

Gloss: 3uaP-seePP MA.DEM. 3-hither-appearNP

Translation: ‘They saw him appear (coming their way)’
7.3.3 Phonological phrasing of nominal words

Ninety-six percent of the independent nominal words in phrases ending in a low boundary tone constituted separate phonological phrases (141 nominals). Fifteen other independent nominals occurred in H% phrases, in which the tonal demarcation of phonological phrase boundaries is suspended, as described in Chapter 2.

All four examples of integrated nouns are from the CUCKOO text. Man-bunbarr, ‘a herb used for flavouring meat’\(^\text{18}\), is integrated with the following verb, ø-mey, ‘he took’. Kun-red, ‘NC.neut.-camp’, is followed within the phonological phrase by an adjective, djarre, ‘far away’ (see Figure 7.11)\(^\text{19}\). Borndok, ‘spear thrower’, is prosodically integrated with the accented discourse interjection bonj, ‘that’s it; done’. Kun-mo, ‘bones’ follows the verb with which it integrates, kabi-we, ‘he throws [his bones] away’.

Independent nominal expressions often constitute not only a separate phonological phrase, but also a separate intonation phrase, from any verbal word to which they are related grammatically or pragmatically (see Figures 7.12 to 7.14). ‘Afterthought’ nominals tend to occupy a separate utterance constituent, preceded and followed by a silent pause, following the verbal word.

In the example shown in Figure 7.12, the word ku-djen, the equivalent of a prepositional phrase in English (‘with his tongue’), is focused (‘He ate the eggs with his tongue’). As is typical for focused nominals, the word is fronted in the utterance (Evans, in press: §13.2.2). However, as the relative prominence relations between ku-djen and nguneng indicate, the focused word forms a single intonation phrase with the following verb. This is in spite of its clearly ‘adjunct’ grammatical status. On the other hand, the nominal dabu-no, followed by the demonstrative nawu, which marks it as the topic of the

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\(^\text{18}\)Translation from Garde (ms). Draft dictionary of Kuninjku.

\(^\text{19}\)An alternative analysis of this phrase may be that it is a fixed idiom or a compound, comparable to gu-bolk-djarre in Mayali or kurnh-balay in the related language Dalabon (Evans, pers.comm.). The two analyses could be distinguished on the basis of further tokens, if kun-red djarre was never found to occur with an Lp tone between kun-red and djarre.
utterance, forms a separate intonation phrase following the verb. Postposing of topicalised nominals is common in BGW: refer to Evans (in press: §13.2.2).

Figure 7.13 shows the phrasing of a preposed nominal object (co-referential with a zero object pronominal prefix on the following verb); the nominal forms a separate intonation phrase. Figure 7.14 illustrates the phrasing of a postposed subject nominal (co-referential with the subject prefix bene-, ‘the two of them’, on the preceding verb), which again forms a separate intonation phrase from the verb.

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**Figure 7.11:** Prosodic integration of a nominal, *kun-red*, and an adjective, *djarre*.

Transcription: *kun-red djarre*
Gloss: IV-camp far.off.
Translation: ‘A distant camp.’

**Sound file 7.11**

```
H* H* Lp-%
kun-red djarre
```

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this would support a compound word/idiom analysis. The intonation of this single example is ambiguous between prosodic integration and a single-word hat pattern.
Figure 7.12: Typical phrasing of a verb and postposed nominal object in Kuninjku.

Transcription: ku-djen ø-nguneng dabu-no nawu
Translation: He ate the eggs with his tongue
Gloss: LOC-tongue 3/3plP-eatPP egg-3POSS MA.REL.

Sound file 7.12

Figure 7.13: Typical phrasing of a verb and preposed nominal (co-referential with the (zero) object pronominal prefix).

Transcription: djalamarddawk bene-nguneng
Gloss: wild.passionfruit 3uaP/3-eatPP
Translation: They ate wild passionfruit…
Figure 7.14: Typical phrasing of a verb and postposed nominal (co-referential with the subject pronominal prefix bene-).

Transcription: bene-h-bo-roy al-dah-daluk
Gloss: 3ua/3-IMM-liquid.hitPP II-REDUP-woman
Translation: ‘The two women struck the water (with their hands).’

7.3.4 Phonological phrasing of other lexical classes

7.3.4.1 Demonstratives

Of the seventy-two demonstratives in the CUCKOO and BILLABONG texts, 57% (in phrases ending in a low boundary) form separate phonological phrases. Fifteen (21%) are unaccented, and precede or follow another word within a phonological phrase; eight are accented and prosodically integrated with the following word to form a single phonological phrase. A further eight occur in a high level phrase ending in an H%.

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20 See section 6.5 for an explanation of this label, which indicates stylised lengthening together with sustained high F0.
boundary, in which the tonal demarcation of phonological phrase boundaries is suspended.

As Table 7.2 shows, the number of tokens of each type of demonstrative in the transcribed texts is quite small, so generalisations about their phrasing must be tentative at best. The figures in Table 7.2 show that no 3-syllable demonstrative in the data set underwent phonological integration with another word into a single phonological phrase. More data are needed to determine whether the relationship this suggests between phonological size in syllables and the phonological integration of demonstratives is real or not – i.e. whether integration tends to affect only the 2-syllable demonstrative series. Alternatively, it may be that the difference in phrasing relates to functional differences in the discourse uses of each series.\(^{21}\)

The locative demonstrative *kumekke* is most frequently used pronominally, with the meaning ‘there, that place’\(^ {22}\), while the *namekke* series is commonly used for what Himmelmann (1996) refers to as a ‘singling out’ function, in which a referent which is generally already established in the discourse is highlighted in relation to a new action or event. The *nakka/ngalkka/makka* series is typically used in contexts in which the referent has just been mentioned in the preceding discourse, or has otherwise just appeared in the immediate context (Evans, in press: §7.3.2.1). The *nani/mani/kuni* series is used in presentatives and when pointing to something in the immediate or proximate physical context (see Figures 7.17 and 7.18). *Nawu* is the only demonstrative in its series found in the two narratives analysed. It is principally used for a function Evans (in press: §7.3.2.1; after Himmelmann, 1996) refers to as the ‘recognitional’ function. When *nawu* accompanies a first mention, it indicates that the speaker expects the referent to be already known to the hearer or to become identifiable upon further description. It may also be used for re-mentions. When used for an initial re-mention, *nawu* tends to precede the nominal it modifies. On subsequent mentions, *nawu* tends to either directly follow the nominal, or to follow a verbal word which indexes in a pronominal prefix the referent to which *nawu* refers.

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\(^{21}\) Nicholas Evans, pers. comm.
\(^{22}\) As in the phrase *ben-nang kumekke*, ‘he saw them there’. Evans (in press: §7.3.1.3) gives an example of a rarer adnominal use from the Gun-Djeihni dialect: *gu-mege bim*, ‘that painting there’. 

410
Nawu is more frequently unaccented than the other demonstratives in this sample, and tends to enclitise to another demonstrative (as in nakka=nawu and nani=nawu). The nawu series is used in BGW in the formation of relative clauses (Evans, in press: §7.3.2.1, 14.3). When serving this function, unaccented nawu may encliticise to the head of the relative clause within a phonological phrase, as in the utterance nungkah=nawu [he=who] bi-djum-dadj' yerrih, ‘he who cut [another man’s] neck earlier’: see Figure 7.15. Nawu may also occur phrase-initially without accent.

<table>
<thead>
<tr>
<th>Demonstrative series</th>
<th>Total number</th>
<th>Separate PhonPhrase</th>
<th>Integrated PhonPhrase</th>
<th>H% phrase</th>
<th>Unaccented</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-syll</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>namekke/ ngal-mekke/ manekke/ kun-mekke</td>
<td>19</td>
<td>16</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>kumekke</td>
<td>9</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2-syll</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>nanka(nj)/ngalkka/ makka</td>
<td>14</td>
<td>8</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>nani(h)/ mani(h)</td>
<td>11</td>
<td>7</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>kuni(h)/ kune</td>
<td>10</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>nawu</td>
<td>9</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Totals</td>
<td>72</td>
<td>41</td>
<td>8</td>
<td>8</td>
<td>15</td>
</tr>
</tbody>
</table>

Table 7.2: Phonological phrasing of demonstratives in the BILLABONG and CUCKOO texts (Kuninjku)
Figure 7.15: Separate phonological phrasing of the demonstrative *namekke* and the relative clause *nungkah=nawu [bi-djud-dadj’ yerrih]* which elaborates upon the reference of *namekke*.

Transcription: *namekke nungkah=nawu bi-djud-dadj(ke) yerrih na-murnungu wanjh*

Gloss: MA.DEM. he=MA.REL. 3P/3h-neck-chop before MA-responsible then

Translation: ‘So the man who cut [another man’s] neck earlier, the murderer…’

**Sound file 7.15**

<table>
<thead>
<tr>
<th></th>
<th>H*</th>
<th>Lp</th>
<th>H*</th>
<th>Lp</th>
<th>-%</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>namekke</em></td>
<td></td>
<td></td>
<td><em>nungkah=nawu</em></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figures 7.16 to 7.18 illustrate prosodic integration of disyllabic demonstratives with a following word. In Figure 7.16, the following word is a verb; in Figures 7.17 and 7.18, a noun and a nominal phrase, respectively.
Figure 7.16: Prosodic integration of a demonstrative, *makka*, with a following verb *ngurri-bawo*.

Transcription: *makka ngurri-bawo*
Gloss: DEMPRO (III) 2ua-leaveIMPER.
Translation: ‘Leave that one (that’s just been mentioned)’.

Sound file 7.16

<table>
<thead>
<tr>
<th>H*</th>
<th>H*</th>
<th>H*</th>
<th>Lp-%</th>
</tr>
</thead>
<tbody>
<tr>
<td>makka</td>
<td>ngurri- bawo</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figures 7.17 and 7.18 provide an interesting near-minimal pair in terms of their syntactic constituency. The demonstrative *nani* in Figure 7.17 is followed by the nominal *na-dabbolkwarre*, ‘old man’, and the same demonstrative in Figure 7.18 is followed by the nominal phrase *garrart nuye*, ‘his mother’. In each case, the demonstrative *nani* is prosodically integrated with the following noun. However, the syntactic constituency in each case is quite different. *Nani na-dabbolkwarre* is a demonstrative phrase which translates as ‘that old man’. *Nani garrart nuye*, on the other hand, is a complete predication: *nani*, the topic, refers to a picture at hand, and *garrart nuye*, the comment, identifies the image. One might expect this semantic grouping to be reflected in a separate phrasing of *nani*, which is used pronominally in this instance 23, and *garrart nuye*. However, the prosodic phrasing of the demonstrative and the following noun does not reflect the difference in syntactic constituency in this instance.

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23 Evans (in press, §7.3.2.1) cites a comparable pronominal use of the equivalent demonstrative in Kunwinjku, *nahni*: *nahni Wurrukak kakkarrme walabi*, ‘this (painting) (is) Wurrukak holding a fishing net (kakkarrme walabi).’
The following two examples are from Kuninjku and Manyallaluk Mayali, respectively. Although there is no token of *nani* followed by a nominal with which it is integrated in the Kuninjku data, I predict that similar examples with *nani* used as a topic, integrated with a following noun which serves as the comment, would be found in a broader sample of Kuninjku.

![Figure 7.17: Prosodic integration of a demonstrative, *nani*, with a following noun *na-dabbolkwarre*. Example is from Kuninjku (text KL, LK).](image)

Transcription: *nani* na-dabbolkwarre
Gloss: MA.DEM. I-old.person
Translation: 'That old man'.

**Sound file 7.17**

![Sound file](image)
7.3.4.2 Independent pronouns

In the BILLABONG and CUCKOO texts, there are thirty-three tokens of independent pronouns (ngaye ‘I’, ngudda ‘you’, ngaleng ‘she’, nuye ‘he’, ngad ‘we’), including the contrastive/emphatic pronouns (ngalengman ‘herself’, nungan ‘himself’, bedman ‘themselves’, etc.), but excluding possessive pronouns, which have a distinct pattern of distribution. The independent and contrastive pronouns typically precede the predicate within the phrase, while all the possessive pronouns in the present data set follow the predicate.

Twenty-five of the independent and contrastive pronouns (76%) form separate phonological phrases ending in a low boundary tone. Six are prosodically integrated with a following word, and a further two occur in a high level phrase ending in H%. Figures 7.19 and 7.20 illustrate the integration of the independent pronominal nungan, ‘he’ with a
predicate adjective (*darnkih*, ‘close by’) and the contrastive pronominal *ngalengman*, ‘herself’ with a noun, *ngal-badjan*, ‘the mother’.

An independent pronominal to which the discourse marker *wanjh* is encliticised appears to function in a similar manner to the contrastive (topic-switching) pronominals; it also takes the same prosody as the latter (see Figures 7.21 and 7.22 below). Etherington and Etherington (1998) note that in the Kunwinjku dialect, which is closely related to Kuninjku24, the sequence *ngaye wanjh* in isolation (translated as “it’s me!”) produces “very strong emphasis” on the pronoun. Interestingly, this emphasis is not reflected in a pattern of separate phonological phrasing of the contrastive pronominals.

7.3.4.3 Possessive pronouns and possessive adjectives

There are six possessive pronouns in the corpus, all of which occur in the immediate post-verbal position and form a separate phonological phrase. They include tokens of *ngudberre*, ‘your’ (pl.), *ngurrewoneng*, ‘your’ (dual), *ngarrewoneng* (‘our’ (dual excl.)) and *kadberre*, (‘our’, pl. incl.). The fourteen possessive adjectives, some of which are homophonous with the set of possessive pronouns (*nuye* ‘his’, *ngarrewoneng* ‘our’ and *ngudberre*, ‘your’) all follow the nominal they modify as closely as possible, but again, form a separate phonological phrase. *Ngarrewoneng* and *ngudberre* both modify an incorporated nominal in the BILLABONG text: e.g. *ngunh-kornmud-baye ngudberre*, ‘it nibbles (-baye) at your (*ngudberre*) pubic hair (*kornmud*)’. *Nuye* directly follows the independent nominal it modifies.

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24 Kuninjku is sometimes referred to by linguists as ‘Eastern Kunwinjku’.
Figure 7.19: Prosodic integration of the independent pronominal *nungan* with a predicate adjective, *darnkih* (with intensificatory lengthening of the stressed syllable *darn-*; see Chapter 2, §2.3.6.4)

Transcription: nungan darnkih
Gloss: himself close by
Translation: ‘He himself was very close by.’

**Sound file 7.19**

![Sound waveforms](waveforms.png)

Figure 7.20: Prosodic integration of the contrastive pronominal *ngalengman* with a following noun, *al-badjan*.

Transcription: ngalengman al-badjan ø-nalkbom
Gloss: herself II-mother 3P-cryPP
Translation: ‘The mother herself cried’.

417
Figure 7.21: Prosodic integration of an independent pronominal (with discourse marker *wanjh* encliticised) and verbal word into a single phonological phrase.

Transcription: ngudda=(w)anjh ngune-bo-rro
Gloss: you=then 2ua-liquid.strikeIMPER.
Translation: ‘And you two, you clap on the water’.
7.3.4.4 Adverbs and prepositions

Of the thirty-two adverbs other than *kure*, twenty-five (78%) form separate phonological phrases, and the remaining seven are integrated into a single phrase with the following word. The adverbs are all tokens of *konda*, ‘here’, *korroko*, ‘already’, *rawoyh-no*, ‘again’ and *malamalayi*, ‘tomorrow’. Most tokens of the adverb *konda* are prosodically integrated with a following word (see Figure 7.23). *Konda* frequently occurs in initial position in the phrase; it may be that this positional preference plays some part in the tendency for it to integrate into a single phonological phrase with the following word(s) it modifies.

There are three homophonous senses of the word *kure*. It is the most common preposition (meaning ‘to’/‘at’), it is used as a relative pronoun (‘where’) and as a locative adverb (‘there’). In order to examine the three senses for different phrasing patterns, *kure*

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25 *Kure* may derive historically from *ku-red*, LOC-place, ‘at the place’ (Evans, pers.comm.).
in the locative adverb sense was separated out from the other adverbs. However, in the
Chi statistic reported in section 7.3 above, tokens of the locative adverb *kure* were
counted together with the other adverbs. The prepositional use of *kure* did not occur in
the BILLABONG or CUCKOO texts. Two tokens do occur in the KUNKURRNG text,
however, and in both cases the preposition prosodically integrates with the following
noun, which which it forms a prepositional phrase. The patterns of phrasing observed
across the relatively small number of tokens of *kure* as a relative pronoun and as a
locative adverb do not differ significantly, in each case favouring separate phonological
phrasing.

<table>
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<th>misc</th>
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<td>&lt;</td>
<td>H*</td>
<td>Lp</td>
</tr>
<tr>
<td>wanjh</td>
<td>konda</td>
<td>yi-na</td>
<td>nga-rrinh</td>
<td>-bard-mey</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 7.23: Prosodic integration of locative adverb *konda* and following verb, *yi-na* (within a larger
quotative utterance, *Konda yi-na, nga-rrinh-bardmey*).
Transcription: konda yi-na
Gloss: here 2-seeIMPER. 1-properly-knee-causePP
Translation: ‘Look here where I’ve snapped off the bit sticking out’.26

Sound file 7.23

![Sound file 7.23](attachment://sound_file_7.23)

---

26 The translation of this phrase is due to Murray Garde and Nicholas Evans.
Figure 7.24: Prosodic integration of preposition *kureh* and following noun, *karrikad*. (Note that the silence after *kureh* and *karrikad* is due to the combined glottal closure of the glottal stop + voiceless /k/, not a pause.)

Transcription: *kureh* *karrikad*
Gloss: LOC. north.
Translation: ‘(Just there) to the north’.

Sound file 7.24

7.3.4.5 The discourse interjection *wanjh*

When it occurs in phrase-initial position, the discourse interjection *wanjh*, ‘then’, signals a change of action subsequent to, or consequent upon, actions that have gone before. The meaning of *wanjh* as a phrase-final discourse marker – whether encliticised or not – is somewhat different. In the phrase-final position, it conveys a sense of sequence, without the emphasis on change. The two perspectives are somewhat analogous to the difference in English between “then, they went swimming” vs “they went swimming then”.

Evans (in press: §13.10) observes that discourse interjections such as *wanjh* are “frequently integrated intonationally”. Table 7.3 shows that three distinct phonetic realisations of tokens of *wanjh* may correspond to this impression: (1) unaccented, phonological phrase-initial tokens, which generally carry default mid-low F0, before the rise into the initial accent of the phrase; (2) unaccented, phonological phrase-final...
tokens, which generally carry the fall to the low boundary following the final word in the phrase, and in which the onset glide is frequently lost as a correlate of enclitisation (see Figure 7.25, an example from the Gun-Djeihmi dialect); and (3) accented tokens which are prosodically integrated into a single phonological phrase with a preceding or following word (see Figure 7.26).

<table>
<thead>
<tr>
<th>Discourse interjection</th>
<th>Unaccented PhonPhrase-initial</th>
<th>Unaccented PhonPhrase-final (enclitic)</th>
<th>Accented &amp; integrated w. preceding word</th>
<th>Accented &amp; integrated w. following word</th>
<th>Separate PhonPhrase</th>
</tr>
</thead>
<tbody>
<tr>
<td>BILLABONG</td>
<td>25</td>
<td>28</td>
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<tr>
<td>CUCKOO</td>
<td>14</td>
<td>19</td>
<td>2</td>
<td>2</td>
<td>2</td>
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<td>Totals</td>
<td>39</td>
<td>47</td>
<td>7</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 7.3: Phonological phrasing of tokens of the discourse interjection *wanjh*, ‘then’ in two Kuninjku texts, BILLABONG and CUCKOO.

Figure 7.25: Unaccented, encliticised token of *wanjh* in phrase-final position (Gun-Djeihmi; speaker DK). Note that this example shows an emphatic, upstepped H* accent on the verb stem, of the kind described in Chapter 3.

Translation and transcription of this example are due to Nicholas Evans and Janet Fletcher.

---

27 An alternative spelling is *wanyh*.
28 Translation and transcription of this example are due to Nicholas Evans and Janet Fletcher.
Accented, phrase-initial, prosodically integrated token of *wanjh* (Kuninjku, speaker MK).

Transcription: *wanjh* bi-bom alekke
Gloss: then 3P/3h-killPP  FEM.DEM.
Translation: then he killed her.

### 7.4 Prosodic phrasing of unaccented words in Kuninjku

The analysis of prosodic integration I have presented in this chapter assumes that the behaviour of unaccented phonological words within utterances in Kuninjku is distinct from the phenomenon of prosodic integration. There are three patterns of phrasing of unaccented words. The first pattern is enclitisation, most frequently of an unaccented discourse marker (*wanjh*, ‘then’ or *bonj*, ‘that’s it’), quantifier (*rowk*, ‘all’), or demonstrative (typically *nawu*, ‘that one I assume you can identify’ or *nakka*, ‘that one just mentioned/present just now’), to an accented verbal, nominal or demonstrative word.

The encliticised word does not carry a degree of prominence on the metrically strong syllable equal to an accentual prominence, and subjectively, the juncture between the
clitic and the content word is less than an ordinary word juncture. Evans (in press: §13.8) lists other less common clitics, including an interrogative particle (*bukka, ‘eh?’*).

In the second pattern, the unaccented word forms a ‘pre-head’ prior to the first accent in the phonological phrase, and either carries low level F0 or a rising transition into the first accent (see Chapter 2, §2.3.2.1). Subjectively, the juncture between the unaccented and the following accented word is equal to an ordinary word juncture. Exceptions are the monosyllabic connectives *la* and *dja*, both meaning ‘and’, which are never accented, and are typically followed by less than an ordinary word juncture; they are probably best analysed as prosodic proclitics.

Finally, as discussed in Chapter 6, section 6.7.2, there is a pattern in which an intonation phrase-final unaccented word follows a fall to an Lp tone associated with the final accented word, and carries low level pitch. In relation to the analysis of prosodic structure in Kuninjku, little appears to ride on the specific analysis of this pattern: whether the unaccented word is analysed as incorporated into the preceding phonological phrase, or whether it falls directly under the scope of the intonation phrase (but see footnote 21, Chapter 6, §6.7.2).

### 7.5 Conclusion

In Chapter 6, I argued for the existence of a phonological phrase constituent, and that the right edge of this constituent is commonly associated with a low phonological phrase boundary tone, denoted Lp. As shown in Table 7.1 (§7.3.1), the phonological phrase is frequently isomorphic with a single phonological word. Except in cases of cliticisation, the phonological word is also typically isomorphic with the morphosyntactic word. The separation of the two levels of prosodic constituency, the phonological word and the phonological phrase, therefore needs to be clearly motivated. I have motivated distinguishing them by reference to the fact that certain classes of words, such as 2-syllable demonstratives and locative adverbs, and certain grammatical constructions, such as purposive clause sequences, allow or even favour the integration of two accented phonological words within a single phonological phrase. In these integrated phrases, the pre-final word ends in high pitch, rather than an Lp tone. An Lp tone associates to the right edge of the final word in the phonological phrase, as usual.
The prosodic integration of certain semantically highly integrated verb sequences in Kuninjku (such as same subject purposive sequences), and the separate phonological phrasing of perception verbs and their verbal complements, resemble the prosodic phrasing of similar verb sequences in Spanish (Sánchez, 2001) and English (Givón, 1990). However, the intonation units integrated in Kuninjku are at a lower level of the prosodic hierarchy than those posited in relation to these processes in Spanish and English — they are tonally demarcated phonological phrases, not the higher level intonation phrases. The evidence presented in sections 7.3.2 to 7.3.4 on the distinctive phonological phrasing of different lexical classes in Kuninjku indicates that we need to recognise the phonological phrase in Kuninjku as the lowest level of intonationally demarcated “separate phrase” in this dialect. This recognition will underpin future research on the mapping between prosodic and grammatical constituency.
Chapter 8

Conclusion

8.1 Discussion of main findings

In this dissertation, I have addressed central aspects of the phonetics and phonology of intonation and prosody in Bininj Gun-wok. One of the principal aims of the research has been to contribute to the developing project of intonational-prosodic typology, through the analysis of a polysynthetic, Australian language, in a theoretical framework which facilitates cross-linguistic comparison. A subsidiary aim has been to elucidate the relationship between the phonetic realisation of intonational contours in BGW and their underlying phonological structure – what Liberman and Pierrehumbert (1984: 202) referred to “the observable consequences of particular combinations” of the basic intonational entities. I have documented the realisation of these entities with both visual and auditory records.

The research presented has contributed to the typological project on two fronts. First, it has shown that certain intonational features and functions which have been claimed to have a wide distribution across languages, also occur in BGW. Second, I have observed a number of features of the intonation and prosody of BGW which may help to extend our understanding of the range of possible variation in intonational and prosodic systems.

Aspects of intonation and prosody in BGW which also have a broad distribution in other languages include final lowering (see Chapter 6, §6.44; also Fletcher and Evans, 1998), utterance-final lengthening (see Chapter 6, §6.5), and late peak alignment in high pitch accents in utterance-initial position (see Chapter 5, §5.4.7.1). It is also striking that an intonational configuration such as the hat pattern (Chapter 2, §2.3.1), which is observed in many Indo-European stress accent languages including English, Dutch and German, should be common in BGW.

Final lowering, late peak alignment and high intonation boundaries have similar functional ‘meanings’ in BGW to those in other languages in which they have been
observed. Final lowering correlates with finality of a discourse segment; late peak alignment with the onset of a new phrase; and high intonation boundaries correspond to meanings of ‘incompleteness’ or relationship with a following phrase (see Chapter 2, §2.3.5.3). Even the hat pattern in BGW could be seen as serving a similar ‘coherence-lending’ function to that observed in languages such as Dutch, English (Gussenhoven, 1984), German (Grabe, 1998) and Swedish (Bruce, Granstrom and House, 1991).

Gussenhoven (1984: 247) remarks that in English, “semantically, linking [formation of a hat pattern between two accentual tones - JB] causes a certain degree of semantic depletion of the penult tone, the general effect being that the stretch of speech concerned is presented as an integral chunk of information.” In BGW, the hat pattern usually occurs across single phonological words, in which multiple lexical and inflectional morphemes are often bound together.

These observations have relevance to the current resurgent interest in ‘universal’ vs ‘language-specific’ aspects of intonational meaning. Gussenhoven (2002), for example, postulates that universal or near-universal aspects of intonational meaning reside in the phonetic implementation of intonational tones, while language-specific meanings reside in the distinct composition of the intonational grammar and inventory. In Gussenhoven’s terms, final lowering, late peak alignment and high intonation boundaries all emerge from informational interpretations of the ‘Production Code’, first postulated by Ohala (1983, 1984). The Production Code relates to “variation…that is interpreted in terms of initiation and finality” (Gussenhoven, 2002: 51). Specifically, “high beginnings signal new topics, low beginnings continuations of topics. A reverse relation holds for the utterance end: high endings signal continuation, low endings finality and end of turn.” (Gussenhoven, 2002: 51).

Those features of the intonation and prosody of BGW which bear on the possible range of variation in intonational and prosodic systems include the relationship between metrical structure, phonetic stress and accent assignment described in Chapters 3 and 4. At first glance, the relationship between accent and metrical structure in BGW looks quite familiar from English: for example, the manner in which more than one peripheral foot in a word may bear a pitch accent. In English, however, such double accent on words typically occurs when the word is isomorphic with an intermediate phrase; it has been
claimed that the additional accent serves an onset-marking function within the phrase (cf. Shattuck-Hufnagel, Ostendorf and Ross, 1994). In BGW, a second accent appears to serve a similar demarcative function, but at the level of the phonological word, and not a higher level constituent.

In addition, metrical strength in the Kuninjku dialect of BGW is not consistently correlated with the acoustic exponents of phonetic stress common to other stress accent languages: increased duration, intensity and full vs reduced vowel quality. This lends support to Ladd’s (1996) proposal that a language type exists in which postlexical pitch accent, while assigned to metrically strong syllables, is not associated with the usual correlates of phonetic stress – a type for which, to date, the sole exemplar has been Bengali (Ladd, 1996: 156).

BGW (Kuninjku and MM dialects) is also distinct from other stress accent languages in two further respects. First, the range of paradigmatically contrastive accent types (which Fox (2000) refers to as ‘modality’) is very limited in these two dialects, as described in Chapter 5. A corollary is that there is no discernable relationship in these dialects between distinctive pragmatic (or ‘modal’) content of the sort proposed for English by Pierrehumbert and Hirschberg (1990) and Ward and Hirschberg (1985), and accent type. BGW may differ in this respect from another Australian language, Kayardild, in which interactions between lexical semantics and pitch accent choice have been observed (Fletcher, Evans and Round, 2002). In this preliminary study, Fletcher, Evans and Round proposed a tonal inventory with at least three distinctive accents, L*, H* and L+H*, and modifications thereof.

Second, there does not appear to be a correlation in BGW between the presence vs absence of accent on a phonological word, and the status of that word in the information structure. Verbal and nominal words always bear at least one accent, and frequently two, while words from the other lexical classes are much more often accented than not (Chapter 7, §7.3.1). As described in Chapter 3, section 3.11, however, the question does remain as to what conditions the assignment of a single default accent vs the default plus an additional accent, to BGW words.

Finally, evidence was presented for a phonological phrase level in BGW that is tonally demarcated by a low boundary tone, L_p, and is generally isomorphic with a single
phonological and morphosyntactic word. This phrasing gives the impression of utterances filled with ‘word level’ H(H)L contours. In other polysynthetic languages as well, such as the Aleut language Unangan (Taff et al., 2001), West Greenlandic Eskimo (Nagano-Madsen and Bredvad-Jensen, 1995) and Central Alaskan Yupik Eskimo (Woodbury, 1993), a single morphosyntactically and semantically coherent polysynthetic word is isomorphic with the lowest level of intonational contour (refer to Chapter 6, section 6.2.2.1.).

8.2 Future directions

Our understanding of the intonational phonology and phonetics of Bininj Gun-wok is now at a stage where, in an ideal laboratory setting, it would be possible to design perception experiments to test the phonological status of the intonational elements postulated. Such experiments could include adding or removing phonological phrase boundaries in particular grammatical constructions, such as a purposive construction, in order to determine the effects of phrasing on interpretation; or manipulating the relative height of accents in order to determine the effects of relative pitch prominence on the interpretation of broad vs contrastive or information focus. However, practically, there is probably little potential for such experiments to succeed in the current field settings in which BGW is spoken. A corpus approach, focusing on dialogue elicited in a partially controlled manner, such as a collaborative descriptive task involving responses to a picture or series of pictures, is more promising as a means of determining the relationship between intonational elements and grammatical relations or pragmatic meanings. Such an approach would also allow the gathering of relatively comparable data from a larger number of speakers, preferably more than three of each sex (cf. Ladefoged, 1993).

A number of issues for future research have been raised in the course of this dissertation. Several of these would be amenable to study within the context of (relatively controlled) dialogue data. These include determining whether the present intonational inventory adequately represents the intonational variation present in BGW. It may be that the intonation used in interactional settings differs in certain respects from the largely narrative data that has formed the basis of this dissertation. Dialogue elicited in the context of a collaborative descriptive task might also give rise to naturally occurring
interrogative and imperative utterances, of which there are presently few in the BGW corpus.

Language elicited using a relatively fixed set of references, such as provided by a set of pictures, could also be used to examine the relationship between broad, contrastive and information focus and relative prominence relations within intonation phrases.

Finally, it may prove useful to develop a system of annotating manipulations of pitch range within and between intonation phrases in the BGW-ToBI transcription system (§1.6.1.5). Such manipulations would include the successive lowering of one or more phrases of the kind illustrated in Figure 6.1 in Chapter 6, and reproduced below as Figure 8.1 (\textit{wanjh yi-nguneng kun-mekke na-djamun nakka yi-nguneng}, ‘then you ate it, you ate that taboo food’). In this example, there are two intonation phrases, \textit{[wanjh yi-nguneng kun-mekke]} and \textit{[na-djamun nakka yi-nguneng]}. The pitch register of the second, as roughly indicated by the highest and lowest F0 values (but see Chapter 3, section 3.12.2) is considerably lowered relative to the first, as illustrated by the shading of the register of each phrase in Figure 8.1.

![Figure 8.1: Intonation phrase-level register shift in a Kuninjku utterance](image)

431
Evans (in press, §13.1) observes that in BGW,

the fact that core case marking is not assigned by the verb… makes it difficult to show that a particular nominal is truly a subject or object of the verb rather than an adjoined nominating word serving to give extra information about one of the arguments, comparable to an ‘afterthought’ NP in English.

Register shift of the kind illustrated in Figure 8.1 is a cue to intonation phrase juncture which may assist hearers in the disambiguation of grammatical relations: for example, in determining whether an external nominal is an argument in a given clause, or an adjunct, such as an afterthought expression. Annotation of upward and downward register shifts might shed light on whether there is a systematic prosodic distinction between the two types of grammatical relation.
**Appendix**

**Further examples of accent assignment in Kuninjku words**

<table>
<thead>
<tr>
<th>Text/Location of accent</th>
<th>Left-most foot only</th>
<th>Right-most foot only</th>
<th>Both left- and right-most feet</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CUCKOO</strong></td>
<td>bi-yawam, bi-nguneng</td>
<td>bi-djal-bom, bi-kerri-bom, bi-warrewong, yi-bok-mang, yi-bok-kan</td>
<td>yawoyh-rru(rru-dad)djeng, yi-mo-mang, bi-djal-nanganang</td>
</tr>
<tr>
<td>Left-most and medial feet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>djaj-kundjang melmeng, da-rrahmey=wanj</td>
<td>bene-djal-kurrmerrinj</td>
<td></td>
<td>bi-bak-bakkeng</td>
</tr>
<tr>
<td><strong>BILLABONG</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left-most foot only</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bi-rrulubom, yi-nguneng</td>
<td>nga-rradjje, yi-libne</td>
<td></td>
<td>yi-yakwa, kuin-dabu-bakmeng</td>
</tr>
<tr>
<td>Left-most and medial feet</td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>kele-kele-kayhmeng, birri-kom-dukkang,</td>
<td>bi-djurd-dadjleng, bi-kuk-kurremeng</td>
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<td>bi-djal-nguneng, birri-dalk-berreweng</td>
</tr>
<tr>
<td><strong>NAMALADJ</strong></td>
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<td>nga-rowen, ben-dukkang, benh-nguneng, bene-djal-kang</td>
<td>bi-barrnameng</td>
<td></td>
<td>bi-barrnameng</td>
</tr>
<tr>
<td>Left-most and medial feet</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>nalk-ki-durh-durndi, nalk-ki-durh-durndeyi</td>
<td>bi-djal-bert-karrmeng, ben-djal-kudjihmeng, bi-woh-barrnameng, kahene-djamdi</td>
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</tr>
</tbody>
</table>
## Examples of accent placement on nominal morphemes (Kuninjku)

<table>
<thead>
<tr>
<th>Text/Location of accent</th>
<th>Left-most foot only</th>
<th>Right-most foot only</th>
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<tbody>
<tr>
<td><strong>CUCKOO</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wirriwirriyak, na-kudji, kun-kudji</td>
<td>wirriwirriyak, na-kudji</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td><strong>BILLABONG</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ngal-dah-daluk, na-wernwarre</td>
<td>—</td>
<td>—</td>
<td>—</td>
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<tr>
<td><strong>NAMALADJ</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>na-wernwarre</td>
<td>—</td>
<td>kun-kudji, na-wernwarre</td>
<td></td>
</tr>
</tbody>
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<table>
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<tr>
<th>Text/Location of accent</th>
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<th>Right-most and medial feet</th>
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<td>—</td>
<td>na-birinj-kobeng</td>
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<tr>
<td>ngal-dah-daluk, na-wernwarre</td>
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<td>—</td>
<td>ngal-dah-daluk</td>
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<td>na-wernwarre</td>
<td>—</td>
<td>kun-kudji, na-wernwarre</td>
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<th>Both left- and right-most feet</th>
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</thead>
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<td>man-mayh-dedj na-yah-wurdurt</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

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Page 434
## Examples of accent placement on verbal morphemes (MM)

<table>
<thead>
<tr>
<th>Text/Location of accent</th>
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<th>Right-most foot only</th>
<th>Both left- and right-most feet</th>
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</thead>
</table>

<table>
<thead>
<tr>
<th>Left-most and medial feet</th>
<th>Right-most and medial feet</th>
<th>Medial foot only</th>
</tr>
</thead>
<tbody>
<tr>
<td>gu-gabo-gabo, gabimitj-durnde, gadolo-dolpme, ba-nulknoguni, yi-mimbapgeyi, ban-jare-buni</td>
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<td></td>
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</table>
### Examples of accent placement on nominal morphemes (MM)

<table>
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<tbody>
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<td>gu-watda</td>
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<td>ja-tidh-ngong</td>
<td>ngan-yawok</td>
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<td></td>
<td>da-tudji</td>
<td>an-guji</td>
<td>marlaworr-no-yi</td>
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<tr>
<td></td>
<td>da-burrgen</td>
<td>an-g(a)Ururtj</td>
<td>wurdu-wurdurt</td>
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<tr>
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<td>dahu-gen-no-yi</td>
<td>an-wohmi</td>
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<td>na-jal-wern</td>
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</tr>
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<td></td>
<td></td>
<td>ya-yaw-no</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>gun-balem</td>
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<tr>
<td><strong>Left-most and medial feet</strong></td>
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<td>gun-marlawor-doreng</td>
<td>na-gih-gimuk</td>
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465


Author/s:
Bishop, Judith

Title:
Aspects of intonation and prosody in Bininj gun-wok: autosegmental-metrical analysis

Date:
2002

Citation:

Publication Status:
Unpublished

Persistent Link:
http://hdl.handle.net/11343/39569

File Description:
Thesis

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