TONAL ALIGNMENT IN MAYALI

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ABSTRACT

This study addresses two key areas of intonational research, (1) the scope of typological variation in intonational phenomena, and (2) the description of tonal alignment and timing, as they relate to two dialects of the Mayali language, Manyallaluk Mayali and Gun-djeihmi, spoken in Northern Australia. Some evidence of alignment patterns in pitch accent timing similar to those reported for intonation languages such as English and Swedish was found for the two dialects. Thus peak delay was significantly correlated with overall syllable duration, though further analysis of Manyallaluk Mayali suggested the degree of correlation depended on whether the peak fell on the initial or second syllable of the accented foot. There was no consistent effect of nuclearity on peak delay, though for Manyallaluk Mayali again this seemed to depend on the location of the peak within the foot.

1. INTRODUCTION

While a pitch accent may be said to be phonologically associated with the stressed syllable of a word, phonetically, the pitch target (peak or trough) is often realised on an adjacent, unstressed syllable. Factors potentially conditioning the alignment of an accent with the segmental string have been shown to include the segmental composition and duration of the accented and post-accentual syllables; nuclearity, or the position of the accented word within the prosodic structure of the utterance; and idiolectal variation in alignment strategies across speakers.

The present study investigates three further sources of potential variation in tonal alignment, namely (1) utterance type, (2) dialect, and (3) differences in peak alignment related to foot structure. Two utterance types (declarative and WH-interrogative) were recorded and analysed for one dialect, Manyallaluk Mayali. Results of analyses for the two utterance types are presented in sections 3 and 4. Declarative utterances for both dialects were taken from narrative texts; the questions were elicited citation forms. All data presented in this paper were recorded in the field in the Northern Territory by the first and third authors. A description of Mayali foot structure as it relates to peak alignment is given in section 2 below.

2. THE PROSODIC STRUCTURE OF MAYALI

Preliminary studies indicate that Mayali has lexical stress; feet are preferentially binary and left-headed. Pitch accents (H*, L*, H*+L) may phonologically associate with the stressed syllables. The nuclear tone in Mayali is the last prominent accent in the intonational phrase. [1, 2, 3, 4] A preliminary phonological analysis of Manyallaluk Mayali suggested that foot structure may constrain peak alignment under certain conditions. Specifically, where the foot is ternary, the penultimate (post-stress) syllable almost invariably bears the pitch peak, while the initial syllable is audibly stressed. This appears to be so regardless of utterance type and position.

The preliminary phonological analysis suggested three sources of post-stress peaks in left-headed feet in Mayali (é indicates the location of stress, e the location of the peak): (1) simple late alignment of a syllable 1 accent: gáni ('s/he-sits''), nyále, nyále ('what'); (2) 'peak attraction': the first foot has an accent rising to a peak on the second syllable when the final foot in the word bears a falling accent: ga-[d—lo]-[d—lpme] ('it-floats.around' *(check meaning)*), [wúrdu]-[wurdurt] ('children'), [gándi]-[gerri]-[w—rrhme] ('you.for.me *(check)* -ground.oven-light.fire', 'make a ground oven for me'); (3) consistent peak alignment after the onset of the second syllable in trisyllabic left-headed feet, as noted above: bárrini ('they-sit'), ngúrrurdu ('emu'), bért-no-yi ('tail-POSS-COM', 'with its tail'), [nyálegen] ('what-GEN', 'what for')[1].

There are a number of possible ways of measuring peak delay for peaks located in the second syllable of the accented foot. Each method of measurement carries its own assumptions. Measuring peak delay for post-stress syllable peaks from the onset of the post-stress syllable (C_20) assumes the independence of the stressed initial syllable and the second, post-stress syllable in relation to the onset of the pitch accent-related rise. That is, the onset of either the initial or second syllable may be the 0% anchor point for the onset of the accent rise. Peak delay is correlated with the syllable duration of the syllable bearing the peak. Using this method, a strong positive correlation between syllable duration and peak delay for syllable 2 peaks would indicate that C_20 does constitute the phonological 'onset (0%) point' for the accent rise. The second method (similar to that adopted in [5] for Greek prenuclear peaks) involves measuring peak delay from the initial stressed syllable onset (C0) to the onset of the post-stress syllable 2 (C_20), and correlating this interval with that from C0 to peak location (Pk). This method assumes that the onset point for the accent related rise is the accented foot or word onset (C0), and tests whether or not Pk is in addition associated with, or anchored to, the onset of the post-stress syllable (as indicated by a finding that Pk is located a more or less stable distance from C_20).

In the course of the study, the first method of measurement was initially adopted. That is, peak delay and syllable duration were measured from C0 and C_20 for first and second syllable peaks respectively. The inconclusiveness of the resulting correlations for Manyallaluk Mayali, though not for Gun-djeihmi, suggested that the inclusion of the second syllable peaks measured in this manner may have skewed results for peak delay toward shorter peak delays. In order to test this hypothesis, data from the two Manyallaluk Mayali narrative texts and WH-questions was reanalysed as discussed in sections 3 and 4 below.

3. TONAL ALIGNMENT IN WH-INTERROGATIVE UTTERANCES IN MANYALLALUK MAYALI

3.1 Method

Fifteen WH-questions spoken by one male speaker were selected from citation-forms recorded in the field. The recordings were digitised at 22 Khz using ESPS Waves+. A few citation forms were discarded on the basis of dysfluencies or slowed speech in repetitions. The data were segmented acoustically and an intonational transcription was performed. The intervals measured were from syllable onset (C0) to peak location (Pk) and overall syllable duration. For peaks aligned in the first post-stress syllable of the foot, the interval from the onset of this syllable (C_20) to Pk and the overall duration of the post-stress syllable were measured, in addition to peak delay from the onset of the stressed syllable (C0-Pk). Initial findings suggested that segmental composition did not affect the location of the accent peaks. In fact, this is not surprising, given that most syllable onsets and offsets in both dialects of Mayali are either fully voiced or sonorant.

Accents were categorised as (1) initial/medial (prenuclear) and (2) final (nuclear) in the phrase. At this stage, there is no unequivocal evidence for an intermediate phrase level in Mayali in addition to the intonational phrase. An ANOVA was performed to test the significance of any differences in peak delay between nuclear and prenuclear positions and Pearson Product Moment Coefficients were used to test the correlation between peak delay and overall syllable duration.

3.2 Results and discussion

Peak delay in nuclear and prenuclear peaks was not found to be significantly correlated with overall syllable duration using method 1 (nuclear: $r=0.28$, $p>0.05$; prenuclear: $r=-0.18$, $p>0.05$). Removing second syllable peaks from the data frame, however, revealed a significant positive correlation between syllable duration and peak delay for both nuclear and prenuclear peaks ($r=0.53$, $p<0.05$; $r=0.93$, $p<0.0004$).

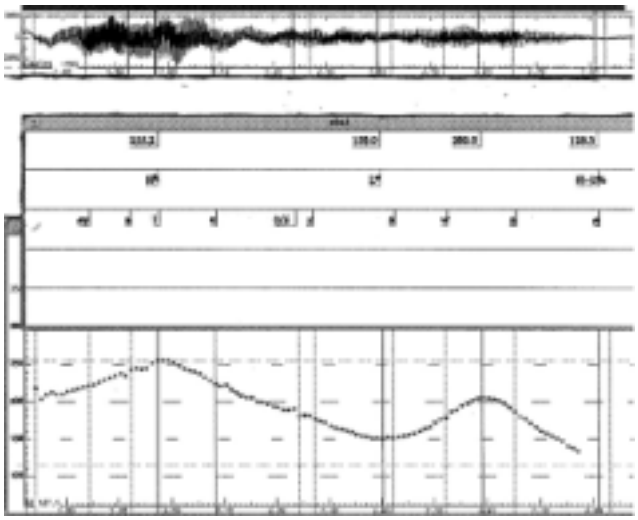

Figure 1. 'Nyale yi-yawan?' ('What are you looking for?') Contour of a WH-interrogative question in Manyallaluk Mayali

Second syllable peaks in prenuclear position were then correlated with initial syllable duration (method 2) to test the strength of the association of the peak and the post-stress syllable onset. The accents in this data set were all of 'type 1' (refer to Section 2). The highly significant correlation which resulted indicates that both stressed syllable onset and post-stress syllable onset serve as anchor points for the alignment of the accent rise in this set of peaks: ($r=.99$, $p<0.0001$). There were insufficient data points in nuclear position to allow an effective statistical analysis.

With regard to differences in peak delay between nuclear and prenuclear positions, absolute peak delay was found to be significantly longer in nuclear position than in prenuclear for initial syllable peaks ($F=5.50$; $p<0.05$). However, combined initial and second syllable peak measurements using method 1 returned a non-significant result ($p>0.05$).

4. TONAL ALIGNMENT IN DECLARATIVE UTTERANCES

4.1 Method

Three Gun-djeihmi narratives of between 2 - 5 minutes in duration and two Manyallaluk texts of 1.5 - 4 minutes in duration were analysed in this part of the study. The subjects were three male speakers of Gun-djeihmi and one male speaker of Manyallaluk Mayali. The same analysis procedure described in 2.1 was used in this part of the study. An auditory transcription was made and an acoustic intonational analysis performed to identify tonal events corresponding to pitch accents and boundary tones. The following measurements were obtained: overall syllable duration, and peak delay (ms) of the F0 target from the onset of the accented syllable. The same statistical method was applied. All texts were analysed separately.

4.2 Results and discussion

4.2.1 Correlation between peak delay and syllable duration. Results for measurements of peak delay and overall syllable duration are presented in Table 1. In Gun-djeihmi, using method 1, peak delay was significantly correlated with overall syllable duration in both prenuclear and nuclear accented syllables for two of the texts ($r=.49$; $p<0.05$; and $r=.35$, $p<0.02$) and only in nuclear accented syllables for the remaining text ($r=.63$, $p<0.0001$). The H* target was reached later in longer syllables and earlier in shorter syllables.

	Nuclear Peak Delay (ms)	Nuclear Syllable (ms)	Prenuclear Peak Delay (ms)	Prenuclear Syllable (ms)
G1	81	212	116	179
G2	88	212	89	144
G3	106	189	93	152
M1	128	173	99	130
M2	116	217	73	159
MQ	184	200	153	140

Table 1. Mean values (ms) for peak delay and syllable duration in nuclear and prenuclear accented syllables in declarative and WH-interrogative texts

Analysis of the Manyallaluk corpus, however, revealed significant effects of peak location within the accented foot.

For the relatively short text M1, initial analysis using method 1 showed a significant positive correlation between peak delay and syllable duration for peaks in nuclear position ($r=0.61$, $p<0.0001$), but a non-significant negative correlation for the prenuclear condition ($r=-0.22$, $p>0.05$). For the longer text M2, there was a significant but weak positive correlation between syllable duration and peak delay for both nuclear ($r=0.24$, $p<0.05$) and prenuclear peaks ($r=.45$, $p<0.005$).

It was decided to reanalyse the two texts in order to determine whether the inclusion of second syllable peaks had affected the outcome of the correlations. It was hypothesised that removing the post-stress syllable peaks would reveal a stronger correlation between syllable duration and peak delay in the remaining data. Analysis of initial syllable peaks alone did in fact show significant and stronger positive correlations between syllable duration and peak delay in nuclear and prenuclear positions respectively in one of the two texts (M1: $r=0.64$, $p<0.0009$; $r=0.73$, $p<0.05$) and in nuclear position in the other (M2: $r=0.70$, $p<0.0001$). There was a particularly marked increase in correlation for nuclear peaks in M2 and prenuclear peaks in M1. In prenuclear position in M2, however, the correlation only approached significance level. Though not conclusive, these results do indicate an interaction between differing alignment tendencies for peaks in stressed and post-stress syllables in Manyallaluk Mayali. There would appear to be some tendency for peak delay in the post-stress syllable to increase as the duration of the syllable increases; however, the stronger tendency is toward alignment early in the syllable, with raw peak delay both dependent on the duration of the initial syllable and constrained by the anchoring of the peak to the onset of the second. In the following section, the effect of nuclearity on peak delay was examined.

4.2.2 Peak delay differences in nuclear and prenuclear positions in the phrase. For Gun-djeihmi, peak delay was significantly different between nuclear and prenuclear syllables in only one of the three texts ($F=5.89$; $p<0.02$). Although this result appeared to be irrespective of the position of the peak within the foot, further analysis will be required to confirm this.

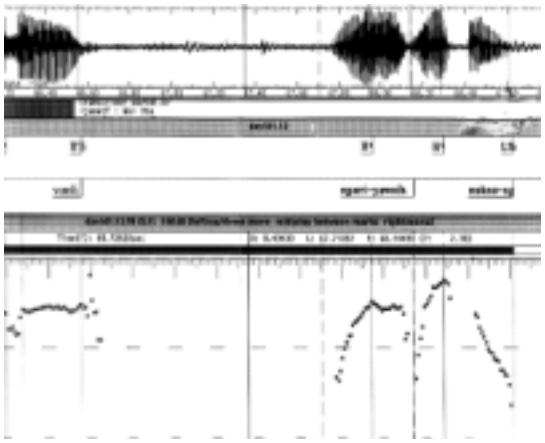

Figure 2. 'Ngarri-yawoih-maknang' ('Let's have a look around again') Contour of a declarative utterance in Gun-djeihmi.

For Manyallaluk Mayali, an extended analysis indicated that for this dialect, it made a significant difference where in the word the peak occurred (refer to Table 2 below). Analysis of variance showed a statistically significant difference between peak delay in prenuclear and nuclear positions for syllable 2 peaks in M2 ($F=5.62$, $p<0.05$). That is, H* peaks occurred later in nuclear position than in prenuclear. However, there was no statistically significant difference between initial syllable peak delay in prenuclear and nuclear positions for M1 and M2 ($p>0.05$). The text M1 contained an insufficient number of second syllable peaks to allow an effective statistical analysis.

	Nuclear Peak Delay (ms)	Nuclear Syllable (ms)	Prenuclear Peak Delay (ms)	Prenuclear Syllable (ms)
M1 s1	110	203	71	148
M2 s1	98	167	83	183
M2 s2	70	201	48	100

Table 2. Mean values (ms) for peak delay and syllable duration in nuclear and prenuclear initial and second syllables of accented feet in declarative texts

4.2.3 Peaks aligned with the post-stress syllable. In Section 2, it was suggested that where the accent-related rise peaks in the post-stress syllable, this syllable onset acts as the anchor point for the alignment of the peak. The choice of the post-stress syllable onset as anchor was made on the basis that a small number of post-stress syllable peaks fell within the onset consonant; the remaining peaks aligned early in the vowel. If this suggestion is correct, the peak may be expected to occur a relatively stable interval after the post-stress syllable onset. On the other hand, one would not expect to find a significant correlation between the interval C_20-Pk and the overall duration of the post-stress syllable. To test this hypothesis, intervals from (1) C0 to Pk and C0 to C_20 and (2) C_20 to Pk and C_20 to C_2C were correlated for M1 and M2 (with the exception of prenuclear peaks in M1, for which there were insufficient data points to allow a statistical analysis). For M1 and M2 respectively, strong correlations between the intervals C0-Pk and C0-C_20 resulted for the nuclear condition ($r= 0.97$, $p = 0$; $r= 0.94$, $p<0.001$) and also for the prenuclear condition in M2 ($r= 0.77$, $p <0.003$). In contrast, there were no significant correlations between C_20-Pk and C_20-C_2C for nuclear or prenuclear conditions in either text. These results indicate that for accents rising to a peak in the post-stress syllable, the peak is anchored to the onset of this syllable, while the 0% anchor for the entire accent curve is the onset of the stressed syllable. For the nuclear condition in M2, all the post-stress syllable peaks were of 'type 3' , while for M1, there was a combination of types 1, 2 and 3 in the data (refer to Section 2). Despite this difference in the source of the post-stress syllable peaks, both texts showed a strong correlation between initial syllable duration and peak delay. That is, all three types of peak appeared to be anchored to the onset of the post-stress syllable.

5. FINAL DISCUSSION

Utterance type did not seem to significantly affect correlations between peak delay and syllable duration and nuclearity and peak delay in the Manyallaluk Mayali data. The one difference between the two types of data was that, for the WH-interrogatives, there was a significant correlation between nuclearity and peak delay for peaks in the initial syllable of the foot, a correlation found only in the post-stress syllables of the declaratives. This may be an effect of the more consistent boundary strength of the final prosodic boundary in citation forms compared with the varied strength or finality of intonational phrase boundaries within continuous texts.

Results of the study so far indicate that both dialects of Mayali show some similarity of patterns of peak alignment to other stress-accent languages such as English [6] and Swedish [7], in that there seems to be a significant relationship between peak alignment and location of lexical stress. However, particularly in Manyallaluk Mayali, we do not see the same kinds of highly constrained, distinctive temporal alignment of the low onset of the pitch accent and the location of the high peak with the lexically stressed syllable as observed in other stress-accent languages. That is, there is a degree of variability in peak location in relation to the phonologically stressed syllable which does not appear to be dependent on the presence or absence of a strong lead tone. This suggests that Mayali does not have the same kind of contrast between L+H* and L*+H pitch accents or Accent 1 vs Accent 2 as observed for English and Swedish, for example. However, there may be some difference between the dialects in this respect. There are low lead tones associated with Gun-djeihmi H* pitch accents which do seem to be more closely temporally aligned with the onset of stressed syllables, which would explain why we find less variation in peak alignment in relation to the stressed syllable in Gun-djeihmi. However, like Manyallaluk Mayali, Gun-djeihmi does not appear to contrast L+H* and L*+H pitch accents.

In Manyallaluk Mayali, the variation in peak alignment appears to be in part a function of the structure of the phonological foot. It may be that post-stress peak alignment in trisyllabic feet responds to a phonological foot level constraint rather than a phrase-level tendency. Further analysis of Gun-djeihmi will be required to see whether this is a tendency that is shared by both dialects.

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NOTES

1. Abbreviations: GEN = genitive suffix; POSS = possessive suffix; COM= comitative suffix.

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