Tone height binarity and register in intonation: the case from Kayardild (Australian)

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Abstract

Autosegmental–metrical analyses of intonation typically assume a binary opposition between L/H tones, realised as pitch targets within some local pitch range, or register. However, because tone and register can be phonologically independent, a theoretical concern is that an ostensibly three-leveled tone system could be analysed in terms of binary tone plus careful register setting. Plateau contours in Kayardild, based superficially around three tone levels, present a case in point. Arguments are provided that just two phonological tones are involved, plus a form of register control that characterises the entire Kayardild intonational system.

Index Terms: intonation, register, tone, representation, Kayardild

1. Introduction

In the autosegmental–metrical (AM) framework of intonational analysis, intonational tunes are represented primarily as a succession of level tones, either H(igh) or L(ow), which are associated with elements in the prosodic structure of an utterance, and aligned in particular ways with the segmental string [1], [2]. Actual intonation contours are considered to be realisations of the tonal string, derived primarily by a process of interpolation between pitch targets corresponding to the constituent H and L tones. Notwithstanding this, a point of debate within the AM framework, discussed at length in [1] is whether, and to what extent, the string of H and L tones is sufficient for representing an intonation contour. Of interest in this paper is the independence of tonal strings and pitch register (where pitch register is taken to be a local pitch range whose extremities provide the pitch levels at which H and L tone targets are set) and the analytical consequences of that independence, in the Australian language Kayardild.

One of the aims of the AM approach is to account for global movements in pitch in terms of local pitch events [3]. The general, cross-linguistic empirical observation to be accounted for is that in addition to there being highs and lows in intonation contours, in most languages and in most contour types there will be larger scale changes in pitch, as a sketched schematically in Figure 1a, which illustrates the case of global declination.

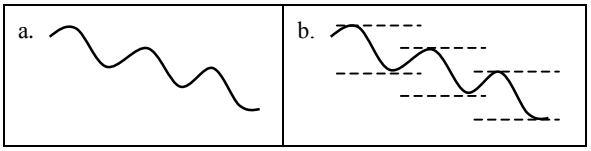


Figure 1: *Global declination, and its analysis in terms of discrete, local shifts in register.*

The standard AM approach is to analyse global pitch movements in terms of local, discrete and discontinuous readjustments of pitch register, as indicated in Figure 1b. An ensuing question is how such discrete movements should be incorporated into the phonological representation of the contour. In Pierrehumbert's 1980 analysis of English [3] for example, discrete downward changes in register (downstep) were triggered automatically after a LH tonal string. In that model, register changes were derivable from, and thus ultimately subsumed within, the representation of the tonal string. As has subsequently been argued [4], [2], this analysis of English is empirically problematic; in fact downstep cannot be predicted from the tonal string alone. If the intonational analysis of English is to maintain a simple binary contrast between H and L tones, then register setting must be represented extrinsically from the tonal string.

In Kayardild too we find evidence that register is set independently of the L/H identity of tones, and thus presumably ought also to be represented extrinsically from the tonal string. In the case of certain contours, this will in turn raise questions of theoretical import: does the appeal to contrastive register-setting merely function so as to allow a fundamentally three-toned system to be cast as binary?

1.1. The Kayardild language

Kayardild is a moribund language of the Tangkic family (non-Pama Nyungan), spoken traditionally on Bentinck Island in the south of the Gulf of Carpentaria, Australia. It has been recorded principally by three investigators: S.A. Wurm in 1960 [5], N. Evans from 1983 to present, and by the author from 2005 to present [6], [7]. Major descriptions of the language are an extensive grammar [8], a dictionary [9] and a recent investigation of phonology and morphology [10]. The intonation of Kayardild has been the subject of two studies. The first culminated in an initial ToBI style analysis, described in §1.2. The second appears as part of the recent phonological investigation just mentioned [10], and is referred to in §§1.3, 2.1.

1.2. Prior intonational research

Fletcher et al. [11] analyse three segments of spontaneous speech, each monologues of 3–5minutes duration, arriving at an initial ToBI-style inventory of tones for Kayardild. Notably, the inventory contains several contrasts which may hinge upon register more than tone, namely: the left boundary tones H–!H described as 'high – lowered high/mid'; the pitch accents LH*–L^H* 'rising – expanded rising'; the pitch accents H*–!H*–^H* 'high – lowered high/mid – expanded high'; and the right boundary tones, likewise H–!H–^H. The present paper does not seek to reanalyse Fletcher et al.'s results, but does pursue the question, raised by those results, of the status of tone and register in Kayardild intonation.

1.3. Kayardild's prosodic structure

Fletcher et al. [11] leave open the question of how intonation relates to metrical/prosodic structure in Kayardild. A recent study of the prosodic phonology of Kayardild [10] confirms that pitch accents are associated with stressed syllables, and boundary tones with larger prosodic domains, of which the breath group (a stretch of speech bounded by planned pauses) is the most relevant. Feet in Kayardild are trochaic, and primary stress falls on the initial syllable of a word.

2. Method and materials

2.1. Empirical basis of the present study

This paper considers empirical properties of Kayardild intonation identified in [10]. That study adopted a complementary methodology to the project described in §1.2, by examining intonational contours selected from a larger database of naturally occurring speech and elicited sentences. Contours were selected for their properties, judged as distinctive by the author (based on several years experience working with Kayardild speech and intonation). Variations on contour types identified in [11] were actively sought in order to generate a corpus which best approximated the full range of contour types in the language.

Contours were analysed using *Praat*, v.5 [12]. Although recordings were made in non-laboratory conditions, sound quality was found to be sufficient for the generation of reliable F_0 pitch tracks in most cases. Where this was deemed not to be the case, the contour was not used in the study. To assist the reading of contours, pitch tracks in the figures to follow are displayed as a thin black line (calculated by *Praat*) overlaid by a thick grey line, determined subjectively.

2.2. Focus of the investigation

The present investigation focuses on the interpretation of major pitch movements in terms of H and L tones and register. To maintain a reasonable limit on the scope of the study, two aspects of intonational structure will be abstracted away from: (i) certain small-scale pitch movements which play out over less than a syllable, and (ii) large-scale patterns of register setting which play out across multiple breath groups; see further [10].

3. Findings

At an initial, descriptive level, Kayardild can be characterised as possessing intonation contours with global declination, contours with global rises, and plateau contours which are globally flat. These broad types and their major features are described in turn below. In figures, each contour is accompanied by a gloss, free translation, and an indication of speaker sex. Vertical lines are placed at the left edge of each foot and at the right edge of the breath group. In the first line of the gloss, stress is indicated by an accent over the vowel.

3.1. Globally declining contours

Globally declining contours are common in Kayardild speech, and typically consist of a single short rise followed by a long fall, or a succession of events which can be described as rise–falls and terrace–falls (in the latter, pitch remains roughly level for a short while before falling). Figure 2 shows a globally declining contour of this type.

Presumably, rise–falls would best be analysed in terms of a LHL tonal sequence, with global declination accounted for in terms of register lowering at some point in this sequence.

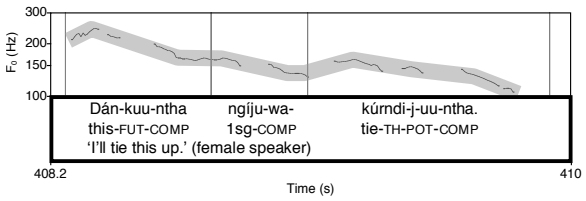


Figure 2: *Globally declining contour with rise–fall, terrace–fall and rise–fall.*

Terrace–falls could be analysed as HHL (with the first two H tones in the same register), or as LHL, with H being targeted within a lower register than the first L. On the latter analysis of terrace–falls, the tonal sequence for both rise–falls and terrace–falls would be LHL; the representational difference would reside solely in the degree to which register drops.

Within a declining contour, a categorical (non-gradient) prominence can be lent to a word by aligning its first (and most prominent) foot with a rise–fall whose pitch peak is at least as high as the peak of the previous rise–fall or terrace–fall. Presumably these categorically elevated rise–falls also receive the same tonal analysis (i.e., LHL) as others, with the point of difference once again being a matter of register control. Figure 3 illustrates an utterance in which the second and fourth words are lent prominence in this manner. (The reader may notice that the 'peaks' in Figure 3 are broader than in Figure 2 — this is a point of variation which is being set aside during the current study.)

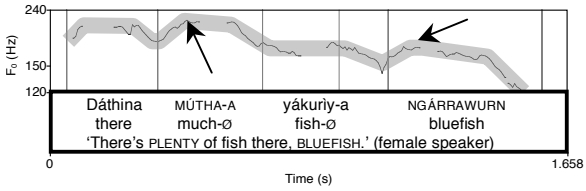


Figure 3: *Globally declining contour with two rise–falls whose peak is as high or higher than the preceding.*

Globally declining contours can end with a right edge rise, as shown in Figure 4. The observation to make at this juncture is that the final rise reaches a pitch level which is higher than one would expect if the contour had not ended, and instead proceeded to a subsequent rise–fall event.

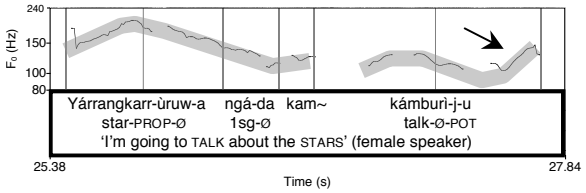


Figure 4: *Globally declining contour with right edge boundary rise.*

In sum, globally declining contours are composed of rise–falls and terrace–falls. Presumably these events are separated by lowerings of the pitch register; an appealing avenue of analysis would be to represent all of these events tonally as LHL, differentiating them solely by the nature of the change in register. A right edge rise reaches a pitch level above what would be expected had the contour continued on to another rise–fall or terrace–fall.

3.2. Globally rising contours

We will refer to 'globally rising' contours as those which rise until a certain point (the most prominent word in the phrase), and which fall thereafter if there is any further material in the utterance. Within such contours, a long stretch of rising pitch will be composed of individual terrace–rises, where pitch is at first roughly flat (beginning around the start of a foot), before rising. If a contour contains many of these individual terrace–rises, it is not uncommon for pitch to drop rapidly between them: this appears to provide speakers with room to rise across each foot without exhausting their total available pitch range.

In Figure 5, a terrace–rise aligns with each of the first three feet; pitch drops rapidly between the first and second. The most prominent word is *thardamijiluruwa*. Prominence is marked by the alignment of the last terrace–rise with the word's first foot. Pitch falls thereafter, beginning with a rise–fall in the word's second foot.

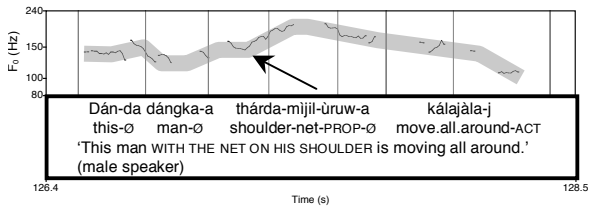


Figure 5: *Rising contour with a non-final, most prominent word, over whose 1st foot the last terrace–rise occurs.*

In general, the shape of individual terrace–rises exhibits a range of variation illustrated schematically in Figure 6. Thick black lines indicate pitch; vertical lines indicate the left edges of successive feet.

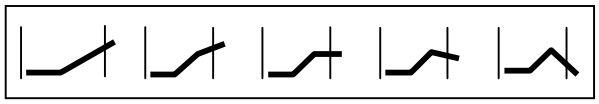


Figure 6: *Variation in terrace–rise events from the left edge of one foot to the next.*

This variation can be analysed in terms of a constant, LLH tonal sequence, plus variation in the extent to which the register is raised (if at all) between successive terrace–rises, a situation with clear parallels to that described above for globally declining contours, where variation was analysable in terms of a constant, LHL tonal sequence, plus variation in register change.

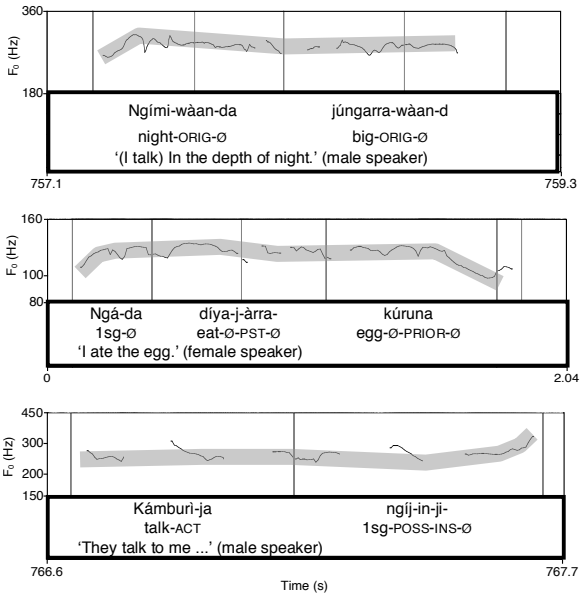
3.3. Globally flat contours

In some cases, plateau contours in Kayardild are essentially flat from beginning to end. More commonly though, plateaux begin with a rise at the left edge (Figures 7, 8), a pitch movement at the right edge (Figures 8, 9), or both.

Presumably the flat section of plateaux should be analysed as interpolation between two identical tones, either HH or LL.

On the first analysis, left edge rises and right edge falls can be analysed as involving L boundary tones — so Figure 7 would be LHH and Figure 8 LHHL, where the L tones are boundary tones, and the H and L tones are all in the same register. Figure 9 presumably would be HHH, where the final H tone is a boundary tone in a raised register.

On the second analysis, right edge rises can be analysed as involving H boundary tones — so Figure 9 would be LLH, with all tones in the same register. Figures 7 & 8 would involve all L tones, with the L boundary tones in a lowered register. We will return to these two analyses in §4 below.



Figures 7, 8, 9: *Plateau contours with level, falling and rising right edges.*

Figure 10 shows a plateau contour in which the first and last words are marked for categorical prominence, by rise–fall events which extend above the plane of the basic plateau. On the HH analysis of simple plateaux, these rise–falls presumably rise to a H target in a raised register; while on the LL analysis of simple plateaux, they would involve a H target within an unchanged register.

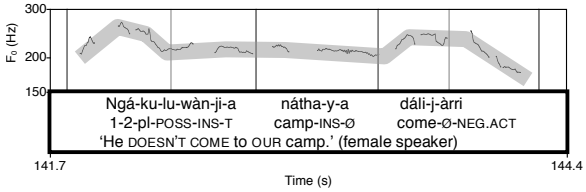


Figure 10: *Plateau contour with two rise–fall prominences.*

3.4. Gradient, emphatic prominence

A phenomenon which should be kept distinct from the categorical effects described above is a gradient, emphatic prominence which is found in globally declining and globally flat contours. This kind of prominence is marked in the usual categorical manner, but with the pitch peak placed at an unusually high level (rises of over one octave have been observed). This kind of event appears to involve a standard rise–fall tonal sequence within a register which is both categorically raised and gradiently expanded, in a manner parallel to the gradient, prominent expansions of categorical tonal patterns which have been observed in English [13].

4. Discussion

This section casts a critical eye on the analysis of Kayardild intonation set out above, focusing on the use made of register, by asking: does register, along with a binary (L/H) tonal distinction, function to encode what should actually be recognised as a ternary tonal distinction in plateau contours? We begin by recapping the two roles played by register above.

Register was relevant firstly in the realisation of pitch accents. In globally declining and globally rising contours, the bulk of the contour was composed of repeated intonational events (respectively LHL rise/terrace–falls, and LLH terrace–rises, aligned with stressed syllables) which are tonally identical, but realised in different registers throughout the contour. In declining contours moreover, the categorical prominent/non-prominent contrast was distinguished solely by a contrast in register setting. In the latter instance therefore, register control is phonologically contrastive.

Secondly, register control played a role in the height of boundary tones. The discussion of plateau phrases in §3.3 cast right edge boundary events (rises, falls and level pitch) in terms of a L/H tonal contrast plus register control. We can now ask whether this was valid.

In fact the shapes of plateau contours are structured around *three* pitch levels: one at the general level of the plateau; one above it; and one below it. Empirical situations such as this are of interest to theory, because they offer an opportunity to reconsider the general AM assumption that tones contrast just two phonological heights: L and H. It would be relatively easy to formulate a face-value analysis of Kayardild plateau contours in terms of a three-way (L/M/H) tonal contrast, with the pitch level of the general plateau corresponding to M; the level below that, found at left and right edges, to L; and the level above it, found at the peaks of prominent rise–falls and in right edge rises, to H. This would result, for example, in an analysis of Figure 7 as LMM, Figure 8 as LMML, Figure 9 as MMH, and Figure 10 as MHMMHL, with the contrastive specification of register playing no part. However, while the ternary analysis makes the description of Kayardild plateau contours simpler, it can be argued that it does so at a cost to the generality of the overall intonational system.

For one, we know from §3.1 that in declining contours, a contrastive raising of register is what signals categorical prominence. Under the ternary analysis of plateau contours, register plays no role in prominence marking, yet under a binary analysis (specifically, one in which the general level of the plateau corresponds to a H tone) it is the case, making the link between raised register and prominence more general across the system.

In addition, it was noted in §3.1 that right edge rises in falling contours appear to involve both a H boundary tone and a raising of register. This is not the case in plateau contours under the ternary analysis, but it is the case under a binary analysis in which the general pitch level is H.

In two respects then, the binary analysis of plateau contours (with H corresponding to the general the level of the plateau) corresponds neatly with the analysis of declining contours, while the ternary analysis does not. That is, the ternary analysis of plateau contours is only poorly motivated once the intonational system as a whole is taken into account.

5. Conclusions

In the AM framework of intonational analysis, it has been argued that register setting can be phonologically independent of tone. There is good evidence from declining contours to suppose that this is the case in Kayardild. It is also possible to employ contrastive register setting in the analysis of Kayardild plateau contours, in tandem with a binary (L/H) tonal contrast. Nonetheless, Kayardild's plateau contours are of interest to theory because at face value, they are structured around three pitch levels. Taken on their own, they admit of a simple, direct analysis in terms of a ternary (L/M/H) tonal contrast, yet a core AM tenet is that intonational tones contrast just two phonological values. When the intonation system of Kayardild is considered as a whole, it becomes apparent that even plateau contours are more elegantly analysed with just two contrastive tones, plus contrastive setting of register.

6. Acknowledgements

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