Intonational Phonology and Prosodic Hierarchy in Malay

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Abstract

This paper presents original data in support of a new model of intonational phonology for Malay as spoken in Singapore. Building on the Autosegmental-Metrical approach (Beckman & Pierrehumbert, 1986), we propose that intonational variation in Malay can be explained in terms of underlying sequences of abstract tonal units (H and L), which are aligned to the edges and internal syllables of prosodic phrases organized in a hierarchy. Data was drawn froma production experiment (Hamzah, 2012) involving declarative utterances under different focus patterns in a question-answer context, as well as from story-telling interviews and TV interviews. We find evidence for at least three levels of prosodic organization: (i) an accentual phrase which comprises one or more words and bears an L and H tone at its left and right edges, respectively, (ii) an intermediate phrase, which serves as the domain of catathesis, and (iii) an intonational phrase, which may span the entire utterance and bears an additional H or L tone at its right edge. Differences in F0 peak alignment for focused words support the presence of a focus pitch accent. We outline a series of follow-up studies for extending the model further.

Index Terms: Malay, intonation, prosody, focus, autosegmental-metrical phonology

1. Introduction

In the Autosegmental-Metrical (A-M) framework (Pierrehumbert, 1980; Beckman & Pierrehumbert, 1986; Pierrehumbert & Beckman, 1988), it is assumed that an intonation contour is composed of an underlying sequence of low (L) and high (H) tones, which occur on a separate tier from theunits of prosodic organization (i.e., syllables and phrases). These tones can be autosegmentally linked to not only the minimal tone-bearing unit (TBU),which may be a syllable nucleus, but also to higher level nodes in the prosodic hierarchy. Not all TBUs are specified for tone in the underlying representation, hence they rely on phonetic implementation rules to get their surface F0 values. The prosodic units are organized in a hierarchy and observe the Strict Layer Hypothesis (Selkirk, 1984, 1986), which states that any prosodic unit at a particular level in the hierarchy consists exhaustively of units from the level directly below it.

In Malay, as spoken in Singapore and peninsular Malaysia, a rise in pitch is observed on the initial and final words in an utterance, (Lorentz, 1997; Tan, 1999; Ng, 2011). Building on these phonetic descriptions, an experimental study reported in Hamzah (2012) and Hamzah and German (2013) provided a constraint-based phonological explanation for a set of contrasts relating focus to intonation. While phonetically, the observed contours were closely in line with earlier descriptions, this study was the first to show how intonation in Malay can vary with pragmatic context. Adopting the A-M framework, which has been used to successfully model intonation in many other languages (e.g. Japanese, Pierrehumbert & Beckman, 1988; French, Jun & Fougeron, 2000; Manado Malay, Stoel, 2005), in this study we propose that intonation in Malay can be characterized in terms of underlying sequences of abstract tonal units (H and L), which are aligned to the edges and internal syllables of prosodic phrases organized in a hierarchy. In focused words, differences in the F0 peak alignment support the presence of a focus pitch accent. Here we provide a preliminary phonological model of intonation in Malay, and also highlight where more investigation is needed to further extend the model.

2. Methodology

In this study, we largely made use of focus-driven contrasts observed in the study by Hamzah (2012) to find evidence for key features of the phonological model. The overall model was then checked against naturally-occurring corpus data (i.e. story-telling interviews and TV interviews), which led to minor revisions.

2.1 Data collection

2.1.1 Production experiment (Hamzah, 2012)

Hamzah's (2012) study involved elicited productions sentences in a question-answer discourse context. The materials included 20 sentences, all with subject-verb-object (SVO) structure, which served as direct answers to wh-questions in four different focus contexts: All-focus, Subject-focus, Verb-focus and Verb Phrase-focus. Thus, the intended focus of the targets was manipulated by changing which syntactic constituent was targeted by the wh-word in the question. For the sentence *Aini memegang oren* 'Aini held an orange' for example, the four contexts were as follows:

(1) ALL-focus (What happened?) [*Aini memegang oren*]$_{FOC}$.

(2) SUBJ-focus (Who V O?) [*Aini*]$_{FOC}$ *memegang oren.*

(3) V-focus (What did S do to O?) *Aini* [*memegang*]$_{FOC}$ *oren*.

(4) VP-focus (What did S do?) *Aini* [*memegang oren*]$_{FOC}$.

12 undergraduates (11 females and one male) from Nanyang Technological University (NTU) participated in the study. All were Singaporean, learned Malay as a first or co-first language,

and reported speaking Malay regularly at home. The recordings took place in a sound-attenuated booth located in the NTU Phonetics Laboratory. Participants listened to pre-recorded prompts by a Singaporean female Malay speaker, and were instructed to produce the answers in a conversational manner, using the sentences provided on a computer screen. Responses were recorded digitally onto a computer using a Shure SM81 microphone at a sampling rate of 44.1 KHz.

2.1.2   Interviews

Naturally-occurring data from interviews in both informal and formal settings was also used in the present study. Four story-telling interviews, each approximately 10 minutes long, were obtained by asking participants to narrate a story or tell a personal account of an event in the presence of an interviewer. In addition, data was obtained from TV interviews, around an hour long, from #FORUMsg 2013 on Suria (i.e. Singapore's official Malay TV channel). This included discussions on current affairs among two interviewers and three interviewees, including two TV viewers who called in.

2.2   Data Analysis

Intonation in Malay can broadly be characterised by prominent F0 rises associated with individual words and syllables. In this study, Praat 5.3.24 was used to carry out visual inspection of the F0 contours, to identify the locations of such F0 rises in the utterances. Following the A-M framework, we then attempted to explain the pitch variations in terms of a series of targets and phonetic implementation rules.

3. Prosodic Hierarchy

Overall, we find evidence for three levels of phrasing in Malay intonation above the syllable level: accentual phrase, intermediate phrase and intonational phrase.

3.1   Accentual Phrase (AP)

Based on the data from Hamzah (2012), SVO declaratives exhibita common patternof F0 rises, similar to previous studies on Malay intonation (e.g. Tan, 1999; Ng, 2011): a rise in F0 onthe subject and the final word in the utterance. In Figure 1, there is no observable F0 rise on the verb, suggesting that the tone sequence in Malay involves a level of phrasing that comprises constituents larger than words.
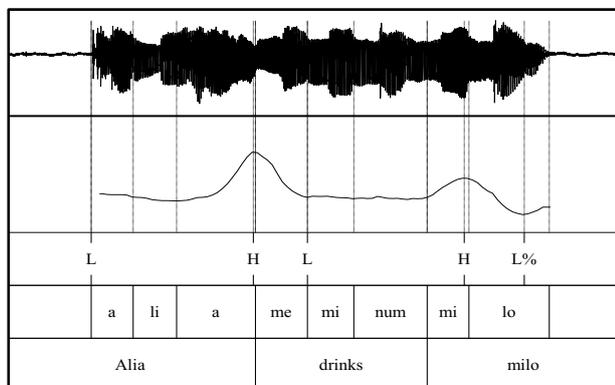

Figure 1: *A typical SVO declarative in Malay*

These facts can be explained by a model that includes the accentual phrase (AP) level as the lowest level of phrasing in Malay, which can contain more than a single word, as in Figure 1, where the subject and verb phrase forms separate APs. Between two APs, F0 always rises at the end of the preceding AP before a rapid fall early in the following AP. This can be explained by an underlying H-L tone sequence, where the H is anchored to the right edge of the preceding AP and the L is associated to the left edge of the following AP.

On this basis, we posit that an AP in Malay has a tone sequence of L-H (as shown in Figure 2), where the L tone occurs on its left periphery while the H tone occurs on its right.
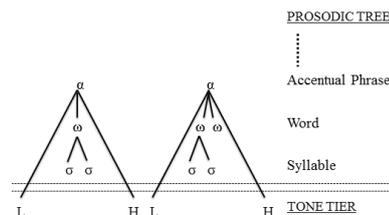

Figure 2: *2 APs, each with an LH tone configuration*

Under the assumptions in the A-M framework, where syllables between tonal targets may be underspecified for tone in the underlying representation, phonetic rules play an essential role in the formation of a fully specified surface representation. The slopes of F0 rises, which vary depending on the number of syllables, can often be explained by a linear interpolation mechanism linking H-L tones in unaccented APs in Japanese (Pierrehumbert & Beckman, 1988), for example, or L-Hi tones in APs in French (Jun & Fougeron (2000). By comparison, in Malay, F0 remains low and relatively constant from the beginning of the AP until the F0 rise on the final syllable. This pattern is better explained by forward tone spreading (c.f. English, where postnuclear syllables get their surface tonal values from backwards spreading of L- and H- (Pierrehumbert, 1980). Thus, we propose that, in Malay,the syllables underspecified for tones receive their surface tonal values by a rightward tonal spreading of the AP L tone.

3.2   Intonational Phrase (IP)

There is a fall in F0 at the end of declaratives and an F0 rise at the end of polar questions, as shown in Figure 3. In addition, at the end of some non-final APs, the F0 rises observed are higher than for a typical AP (Figure 4) suggesting a distinct implementation arising from a sequence of two H tones. We therefore propose the intonational phrase (IP) as a level of phrasing higher than the AP, which has an additional L or H tone associated to its right periphery. An IP typically spans an entire utterance.
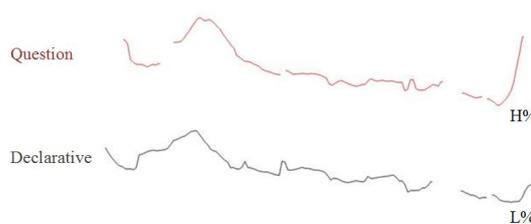

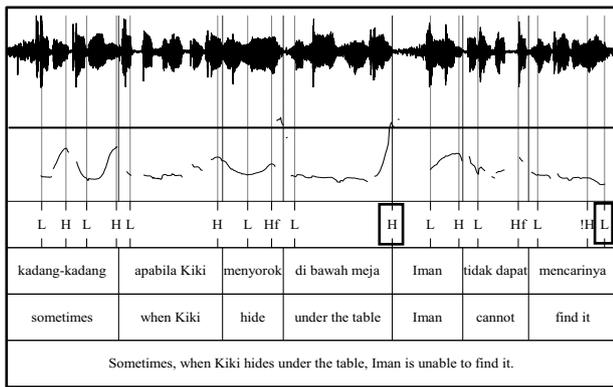Figure 3: *SUBJ-focus context and its in-situ question*

Figure 4: *An utterance illustrating tones/contours likely to be associated with IP boundaries (in boxes)*

For utterance-final APs in declaratives, the F0 rise occurs earlier than in non-utterance final APs, and is followed by a fall at the end of the utterance (Figure 1). This can be explained by the sequence of an AP H tone and an IP L tone at the end of the utterance.

One explanation for the difference in F0 peak alignment between final and non-final APs is that the last H is forced to be realized earlier due to the interplay between temporal ordering requirements and constraints on implementation. In other words, H and L cannot both be realized exactly at the phonetic endpoint of the utterance, so the H is realized slightly earlier. Interestingly, the utterance-final rise occurs on the penultimate syllable of the utterance, *unless* the final word is monosyllabic, in which case the rise-fall is compressed onto the final syllable. This difference is illustrated by the comparison between Figures 1 and 5. For longer utterance-final words, the rise never occurs earlier than the penultimate syllable. Further research is needed to establish the specific alignment properties of utterance-final AP tones, though the facts can potentially be explained if the AP-final H has a secondary association to an AP-internal syllable.

3.3   Prosodic Word

The sensitivity of the utterance-final H to the number of syllables in the final word suggests the presence of a prosodic level between the syllable and the AP. We therefore provisionally posit the existence of a prosodic word in Malay, though further research is needed to establish whether this can be meaningfully distinguished from the lexical word.
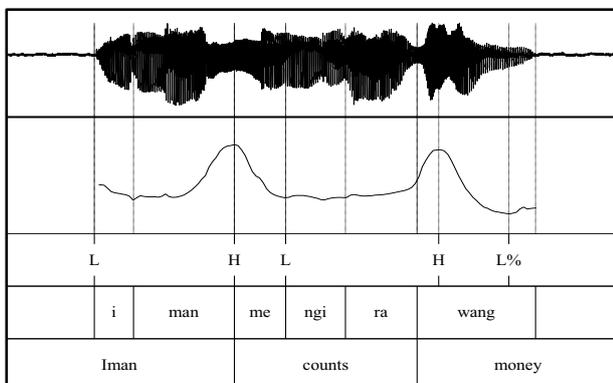

Figure 5: *ALL-focus context with a monosyllabic final word*

3.4   Intermediate Phrase (ip)

Though there do not appear to be any tonal correlates of an intermediate level between the AP and IP, observations from narrow-focus utterances suggest a possible role for such a level. In SUBJ-focus contexts in Hamzah (2012), there are two distinct groups of observations of post-focus sequences. The F0 rises in the post-focus sequences are less distinct in one group but remain distinct in another, as seen in Figures 6 and 7, respectively. Specifically, the post-focus rises of the former group seem to be substantially lower in comparison to ALL-focus utterances. Rather than post-focal deaccenting resulting in the deletion of tones as in French or English (Jun & Fougeron, 2000), the lowering of F0 rises in Malay may be better explained in terms of catathesis. In Japanese, H tones in post-focus sequences are lowered as a result of catathesis, but its effects are blocked by an intermediate phrase boundary (Pierrehumbert & Beckman, 1988). As observed in Malay, catathesis of H tones in post-focus sequences is not always triggered. To account for this variation, we propose a level of phrasing intermediate to the level of AP and IP, which we refer to as the intermediate phrase (ip) level, as the domain of catathesis. Hence, unlike in Figure 6 where an ip spans the entire utterance, in instances like Figure 7, the focused subject forms a separate ip from the verb phrase, blocking the effects of catathesis on post-focus sequences. Further research will reveal whether the presence of such a level can be corroborated by, for example, lengthening or F0 scaling differences at the boundary in question.
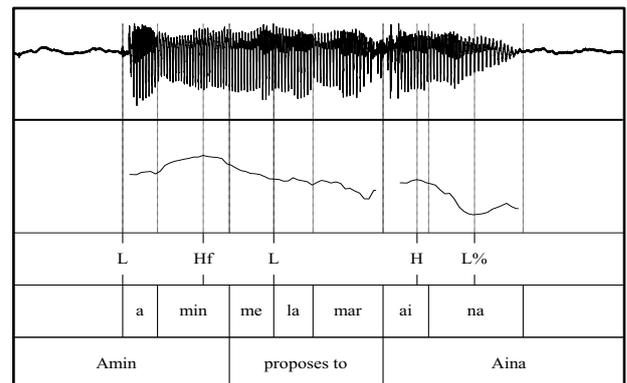

Figure 6: *SUBJ-focus context – Contour exhibits an earlier F0 peak on the subject and subsequent catathesis*
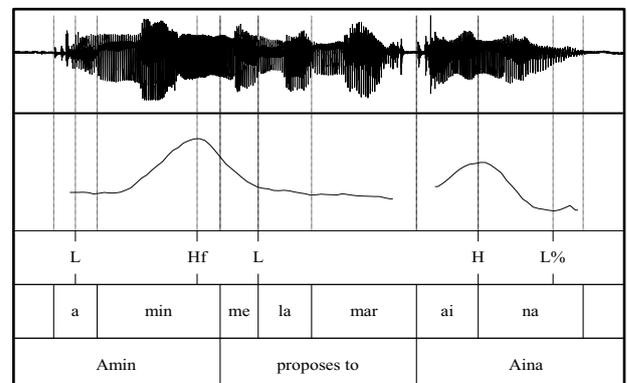

Figure 7: *SUBJ-focus context – Contour exhibits an earlier F0 peak on the subject and no subsequent catathesis*

Figure 8 illustrates the overall proposed model for Malay, based on the hierarchy, tonal features, and associations outlined above.
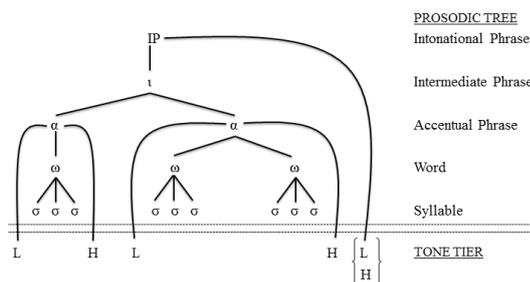
Figure 8: *Proposed prosodic hierarchy in Malay*

4. Focus and peak alignment

Hamzah (2012) found thatintonation is an available focus-marking strategy in Malay. In addition to the observations regarding post-focus sequences discussed in 3.4, focus appears to be marked by differences in the temporal alignment of the F0 peak at the end of the focused constituent. Specifically, in SUBJ-focus contexts (Figure 5), the F0 peak on the subject occurs earlier than in ALL-focus context (Figure 7). We provisionally account for this in terms of a focus pitch accent (Hf), which is associated to the final syllable of focus constituent. In French, the presence of a focus pitch accent results in the deletion of tones within the same AP (Jun & Fougeron, 2000). We propose that focus acts similarly in Malay, whereby the association of Hf to the final syllable of a focused AP triggers the deletion of the default AP H tone, shown in Figure 9 (ii).
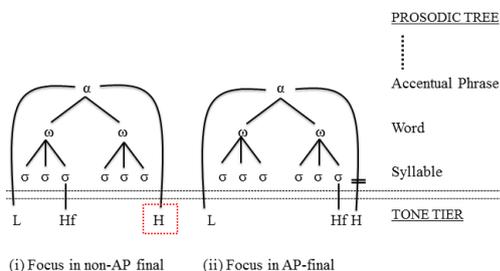
Figure 9: *AP with a focus pitch accent in (i) a non-AP final location and (ii) an AP-final location, showing the deletion of the default AP H*

5. Interaction with morphology

Verbs with suffixes in Malay are observably different from verbs without a suffix. In a VP-focus context like in Figure 10, the alignment of the F0 rise on verbs with suffix –i is earlier than in a typical AP and the F0 riseon the following object within the same ip is lowered. Figure 11 similarly shows an early alignment of F0 rise on the verb with suffix –kan. This observation provides evidence that verbs with suffix –i and –kan are likely treated as focused constituents, where Hf is associated to the final syllable, resulting in the catathesis of H tones in post-focus sequences in the same ip. However, further investigation is required to confirm this as a generalization for verbs with suffixes in Malay.
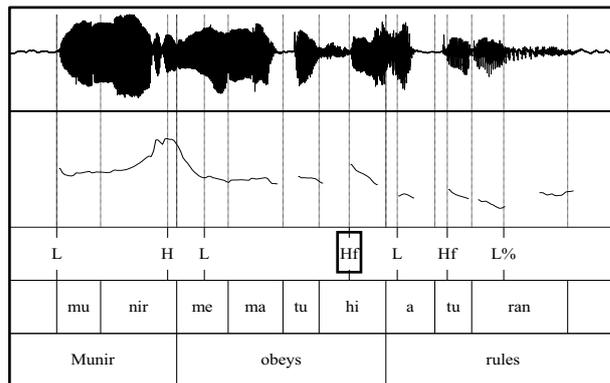
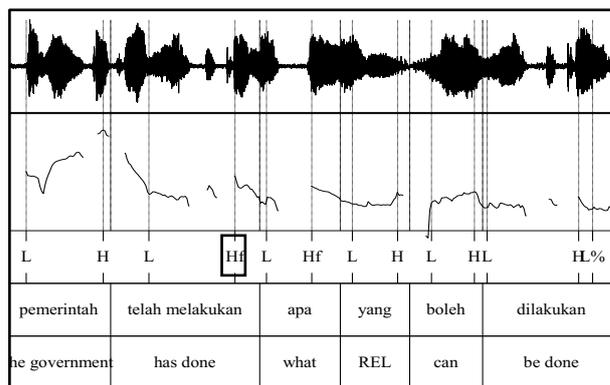Figure 10: *VP-focus including a verb with the suffix -i*

Figure 11: *IP containing a verb with suffix -kan*

6. Conclusion

Using the A-M framework, this study has initiated the development of a phonological model of the intonational system of Malay. Intonation in Malay is observed to be influenced by pragmatic, and possibly morphological, factors, and we have shown that these effects can be successfully captured by the proposed model. Moreover, the generalizability of the model is demonstrated through its application to naturally-occurring speech. Further research is needed to establish the specific alignment properties of the proposed tonal features, as well as to provide corroborating evidence for presence of an intermediate phrase.

7. References

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