

Emphatically Lengthened Segments in Siwkolan Amis: Phonetics and Phonology

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ABSTRACT

Amis (a.k.a. Pangcah) is an Austronesian language spoken on the east coast of Taiwan. We investigate the acoustic properties of the emphatically lengthened segments and to highlight some unique features of the phenomenon from cross-linguistic perspectives. In Amis, stative verbs (adjectives) undergo segmental lengthening to express at least two degrees of emphasis. Segmental lengthening may be either vowel lengthening or consonant lengthening, and it is remarkable that these two types of lengthening are not interchangeable for gradable antonyms. Regarding other stative verbs, “unexpectedness” is expressed via consonant lengthening, while vowel lengthening is used in “regular” emphasis, as the default strategy. The Amis data suggest a possible connection between phonetic naturalness and emphasis, namely that since it is more difficult to lengthen a consonant, using consonant lengthening for expressing emphasis will lead to higher “surprisal” in the signal, which, in turn, may be related to unexpectedness and other possible semantic connotations.

Keywords: Amis, Austronesian, Emphatic Lengthening, Markedness, Phonetic naturalness

1. INTRODUCTION

This paper is an acoustic and perceptual study of emphatic lengthening in Siwkolan Amis. Amis (a.k.a. Pangcah) is an Austronesian language spoken on the east coast of Taiwan. Siwkolan Amis (hereafter Amis) is one of the five major dialects and is spoken in Hualien county. Amis has 17 consonant phonemes /p, t, ts, k, ʔ, ʔ, f, s, l, h, j, w, l, r, m, n, ŋ/ and 4 vowel phonemes /i, a, u, ə/. The maximal syllable is CVC. Like many other Austronesian languages, Amis is a stress language with a canonical word order of VSO. Stress regularly falls on the final syllable of a word and is primarily cued by a F_0 peak. Likewise, declarative intonation in Amis is marked with a $H\%$ in phrase-final position.

It has long been found that in many unrelated languages, both vowel and consonant lengthening can be used for emphasis (e.g., [2]), for example, Rotuman vowel protraction ([5]), Eskimo expressive lengthening ([9], [11]), Japanese ([7]), etc. But the term “emphasis” covers a wide range of functionally different phenomena. To be more specific, we define

emphasis in this study as phonetic manifestations referring to either (i) *expressive intensification* (i.e., “special prominence for amplifying the verbal meaning”) and (ii) *contrast to one’s expectation* (i.e., “degree of affective evaluation of a discrepancy between observed fact and expectation”), based on [8]’s criteria. Our experience is that both are encoded in Amis. See sections 4 and 5 for more detail.

In Amis, emphatic lengthening is found in stative verbs (roughly equivalent to adjectives in other languages). Stative verbs are formed by prefixing *ma-* and suffixing *-aj* to a stem, for example, *ma-lulúʔ-aj* ‘to be yellow’. Emphasis falls on the penultimate syllable of a stative verb, but not the final syllable as in non-emphatic forms. More interesting is the fact that emphatic lengthening in Amis is unique in that, although both consonants and vowels may be lengthened in emphatic forms, there is a strict co-occurrence restriction on consonant and vowel lengthening. Specifically, our observation is that in some cases, vowel lengthening is used, e.g., *awaʔaj* → *awa:ʔaj* ‘few → few_{EMP}’, while in some other cases, consonant lengthening is evoked instead, e.g., *katalaŋaj* → *katal:ŋaj* ‘old/used → old/used_{EMP}’. According to [4]’s results, there are two levels of emphasis, or, Level 1 vs. Level 2. Four speakers were asked to produce as many different emphatic forms as they could for each stative verb (N=65). The results show that 86.3% of the target words have two levels of emphasis and 8.3% have three levels of emphasis.

It is important to note consonant versus vowel lengthening is *not* interchangeable with each other in most cases. We believe that the choice may not be idiosyncratic. That is mainly because (i) the native speakers we consulted with, to a great extent, share the same judgment and (ii) more crucially, we further found that non-gradable stative verbs cannot undergo emphatic lengthening and emphatic forms cannot be negated. It is fair to say that both are grammatically conditioned phenomena.

The goals of this study are two-fold. First, an acoustic and a perceptual study are conducted to document and investigate the acoustic properties of emphatic lengthening and how different degrees of emphasis is perceived. Second, how the choice between consonant lengthening versus vowel lengthening is determined in emphatic forms.

2. ACOUSTIC EXPERIMENT

2.1. Participants

Five Siwkolan Amis speakers (2 males and 3 females; aged 45~65 years old at the time of recording) with normal hearing and no apparent speech deficits were recruited and paid for their participation.

2.2. Materials

The test materials include 83 quadrisyllabic stative verbs. The target words were randomized and embedded into one of following carrier phrases wherever applicable: ___ *hatini* ‘Now it is very ___’, ___ *kura* ‘This stuff is ___’, or ___ *kaku/teijra* ‘I/He is ___’. Each token was firstly read without emphasis (Level 0), then with Level 1 of emphasis and with Level 2 of emphasis, yielding a total of 1,245 tokens (= 83 quadrisyllabic words × 3 levels × 5 speakers).

2.3. Recordings

The recordings were conducted in a quiet classroom of an elementary school in Yüli, Hualien county. We used a digital recorder (Roland Edirol R09), a mixer (Sound Devices MixPre-2) and a headworn unidirectional microphone (Shure Beta 54), which was placed about 1 inch from the speaker’s mouth.

2.4. Data analysis

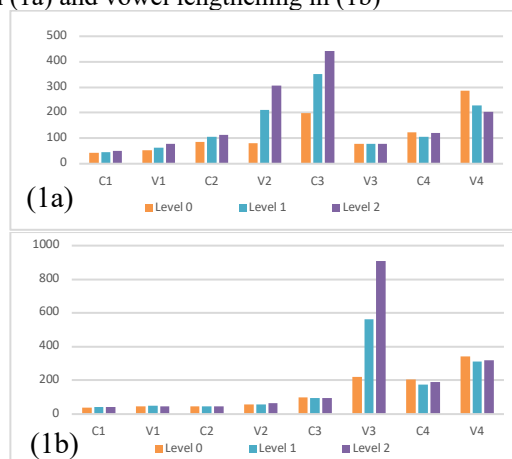
The recordings were digitized with a sampling rate of 44.1 kHz and all acoustic measurements were done by Praat ([3]). The segmentation was based on the beginning and ending points of F2. Manual adjustments were performed to correct irregular glottal pulses with the help of ProsodyPro ([10], version 5.7.8.1). As the general impression is that the emphatically lengthened syllables are characterized by consonant or vowel lengthening and F_0 peak for both Levels 1 and 2, often, if not always, accompanying with a non-modal phonation (falsetto) and voice quality change (pharyngealization) for Level 2. Therefore, in addition to the F_0 values, we included the following measurements for the sake of completeness, namely, the duration of each segment, F1, F2, F3, H1-H2, H1-A1 and H1-A3 at the midpoint of the vowel on an emphatically lengthened (penultimate) syllable.

2.5. Results: Acoustic study

Figure 1 provides a summary of the duration of each segment in three different emphatic conditions. The onset of the penultimate syllable (C3) is significantly longer in emphatic forms, i.e., C3 in Level 2 > Level

1 > Level 0 (> = longer, $p < 0.001$) in (1a). As for vowel lengthening, likewise, the vowel on the penultimate syllable (V3) is significantly longer at Level 2 and at Level 1 in (1b) (> = longer, $p < 0.001$).

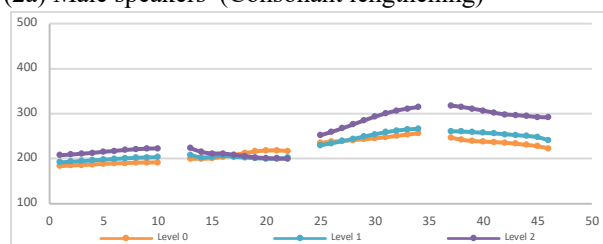
Figure 1: The duration of each segment in different emphatic conditions. Consonant lengthening is shown in (1a) and vowel lengthening in (1b)



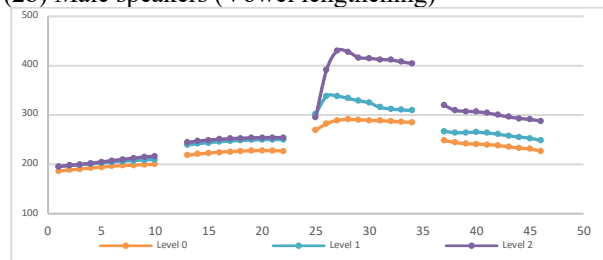
We can see in Figure 2 that there may be a F_0 peak on the penultimate syllable in the emphatic forms: Level 2 > Level 1 > Level 0 for both male and female speakers. We also found that the syllables undergoing consonant lengthening have a high rising pitch contour, whereas the syllables undergoing vowel lengthening carry a high falling pitch contour.

Figure 2: The pitch contours of quadrisyllables in different emphatic conditions: Consonant lengthening (CL) in (2a and 2c) and vowel lengthening (VL) in (2b and 2d).

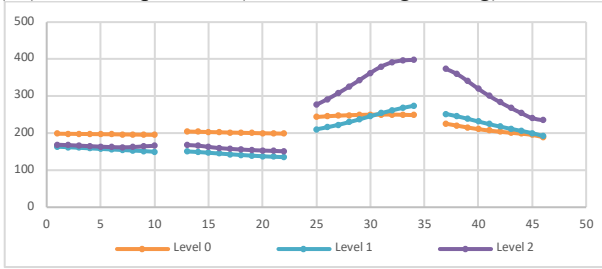
(2a) Male speakers (Consonant lengthening)



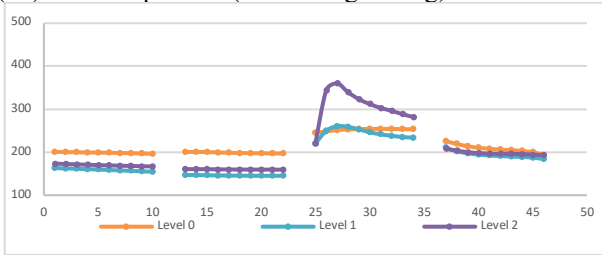
(2b) Male speakers (Vowel lengthening)



(2c) Female speakers (Consonant lengthening)

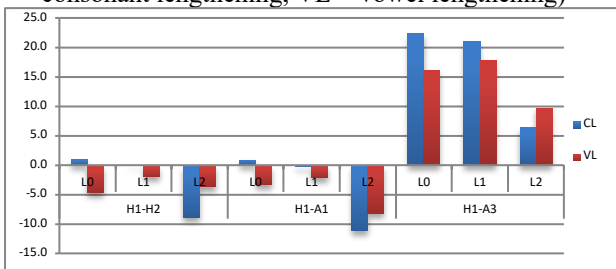


(2d) Female speakers (vowel lengthening)



As mentioned earlier, the vowel on a penultimate syllable tends to undergo pharyngealization at Level 2 of emphasis. This is probably because of the fact that Amis has two guttural sounds: a voiceless pharyngeal fricative /h/ and an epiglottal stop /ʔ/. This observation is confirmed in the acoustic study. Precisely, regarding the cases of vowel lengthening, the emphasized syllables at Level 2 have a lower H1-H2, H1-A1 and H1-A3 than those at Levels 0 and 1, but the difference is only significant for H1-A1 and H1-A3 ($p < 0.001$). As for the cases of consonant lengthening (CL), the emphatically lengthened syllables at Level 2 have a significantly lower H1-H2, H1-A1 and H1-A3 than those at Levels 0 and 1 ($p < 0.001$). The differences between Level 0 and Level 1 are not significant. The results are consistent with what has been reported in the literature. For example, [1] reports that pharyngealization in Jordanian and Moroccan Arabic induces a “tense voice” quality with a lower H1*-A1*, H1*-A2*, H1*-A3*.

Figure 3: The values of H1-H2, H1-A1 and H1-A3 measured at the midpoint of V3 (where CL = consonant lengthening, VL = vowel lengthening)



3. PERCEPTUAL EXPERIMENT

We turn in this section to explore how different degrees of emphasis are perceived by native speakers of Siwkolan Amis.

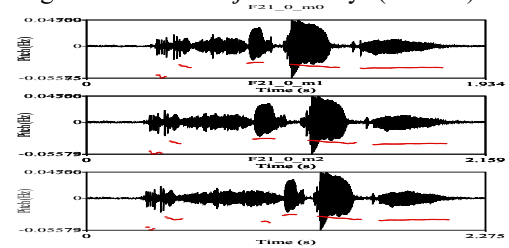
3.1. Participants

Ten Siwkolan Amis speakers (4 males and 6 females) aged 40~63 years old with normal hearing and no apparent speech deficits were recruited and paid for their participation in this study.

3.2. Materials

Six target words produced by one female speaker (i.e., 3 words with consonant lengthening and 3 words with vowel lengthening) were used in this experiment. The pitch values and segment durations were chosen to be close to the grand means of the corpus data. Subsequently, the duration of C3 (i.e., the onset of the penultimate syllable of a quadrisyllabic stative verb) was manipulated for each target word in order to obtain stimuli with the same F_0 value but with three different durations. Nine stimuli were created for each target word as there are three levels of emphasis. See Figure 4 for a sample demonstration.

Figure 4: Three different modified durations of the target word *kaʔəsoʔaj* ‘to be dry’ (Level 0).



In total, 144 trials (= 6 combinations (2 durations \times 3 levels) \times 6 target words \times 2 types (AXB and BXA) \times 2 repetitions) were created for an AXB identification test.

3.3. AXB identification test

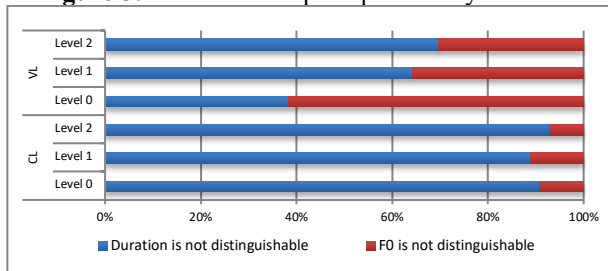
In the AXB identification test, X corresponds to the original target word and A and B differ from X either the duration or F_0 , e.g., $X = \text{Dur}_1$ and F_{01} , $A = \text{Dur}_1$ and F_{00} , $B = \text{Dur}_0$ and F_{01}). Participants were asked to press the response button labeled “1”, if X is similar to A, or “3”, if X is similar to B. The response times were also recorded from the onset of the third stimulus (B). The experiments were conducted in a quiet classroom of an elementary school either in Yüli, Hualien county or in Taoyuan city, Taiwan.

3.4. Results: Perceptual study

The results of the AXB identification test are provided in Figure 5. Regarding the cases of consonant lengthening (CL), participants cannot perceive the durational differences at all three levels. Only 9% of the trials are perceived having a longer duration. F_0 peaks are instead judged to be a more

salient cue, accompanied by phonation/voice quality, i.e., falsetto or pharyngealization. As for the instances of vowel lengthening (VL), 43% of the trials can be reliably distinguished by means of duration. In other words, participants are more sensitive to vowel lengthening than consonant lengthening. We may conclude that these Amis speakers used both cues (i.e., vowel lengthening and F_0 peaks) to perceive and distinguish between different levels of emphasis.

Figure 5: Results of the perceptual study



4. PHONETICS-SEMANTICS INTERFACE?

It remains unclear how the choice between the two types of lengthening is determined. Here, we would like to entertain the possibility that if the choice may well be conditioned on the basis of semantics. Some discussion is in order. Firstly, as a matter of fact, some stative verbs do undergo both consonant lengthening and vowel lengthening, although the emphatic forms convey distinct meanings. For example, we found that vowel lengthening occurs in *malulu:ʔaj* ‘very yellow’, while consonant lengthening is used for “unexpected” forms: *malul:uʔaj* ‘unexpectedly too yellow’. Recall [8]’s “contrary to one’s expectation” and more crucially, vowel lengthening and consonant lengthening are *not* interchangeable in cases of this sort, either. That is, ‘unexpectedly too yellow’ cannot be expressed via vowel lengthening. So it is not impossible to assume that vowel lengthening is the “default” strategy for “regular” emphasis, while consonant lengthening is used in more “marked” circumstances of emphasis.

Secondly, for other cases such as “wide vs. narrow”, “short vs. tall”, etc., we have mentioned that consonant vs. vowel lengthening are, again, not interchangeable in emphatic forms. Remarkably, we found that in gradable antonyms, for instance, *tsifəraŋaj* ‘hot’ opts for consonant lengthening, whereas vowel lengthening is exclusively used in *saʔəmələj* ‘breezy’. Again, we are convinced that the choice is not based on phonetic and/or phonological conditions. These emphatic forms convey what [8] dubbed “expressive intensification” (i.e., “special prominence for amplifying the verbal meaning”). According to [8] and references cited therein, expressive intensification comes into two types, namely that (i) positive, “expression of pleasure,

likely to be signalled by strengthening sonorous features of the accented syllable, especially nucleus lengthening, e.g. *it’s deLlicious!*”, and (ii) negative, or, “expression of dislike, by weakening sonorous features of the accented syllable, initial consonant lengthening at the expense of the nucleus, e.g. *it STINKS!*”. Returning to Amis, it is not clear to us how and why “breezy”, for example, opts for sonority-strengthening positive emphasis (presumably, vowel lengthening), whereas “hot” chooses sonority-weakening negative emphasis (again, presumably, consonant lengthening). But it is likely that for gradable antonyms, the choice between consonant vs. vowel lengthening must be somehow related to the “positive” vs. “negative” distinction of emphasis. We leave this issue for future research.

5. DISCUSSION

Siwkolan Amis distinguishes at least two Levels of emphasis (Level 0, Level 1 and Level 2). Both consonants and vowels can be lengthened in emphatic forms. But consonant vs. vowel lengthening is basically not interchangeable for gradable antonyms. We found that consonant lengthening is used when the target word has an “unexpectedness” connotation, so vowel lengthening is the “default” strategy for emphasis. To this end, we may entertain the possibility that markedness is rooted in phonetic naturalness. More precisely, since it is phonetically easier to lengthen a vowel, using vowel lengthening for emphasis will result in lower “surprisal” (or Shannon’s information in context, broadly construed; [6]). In contrast, it is phonetically more difficult to lengthen a consonant; so using vowel lengthening for emphasis will result in higher “surprisal”, i.e., unexpectedness. The Siwkolan Amis data seem to suggest that different semantic categories may be phonetically emphasized in a distinct fashion. It is worth exploring if the choice between consonant vs. vowel lengthening may be mediated via phonetic naturalness and “Surprisal” in the signal.

6. CONCLUSION

In this work, we have shown a potentially promising connection between phonological markedness, phonetic naturalness and in the realm of non-lexical distinction, i.e., emphasis conveying unexpectedness and/or expressive intensification in Siwkolan Amis.

7. ACKNOWLEDGEMENTS

This study has been approved by the National Tsing Hua University’s Research Ethics Committee (#10612HS090). We would like to thank Pierre Hallé for his assistance with the perceptual experiment and, especially, the Amis speakers for their participation.

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