

Tonal allophony in Vietnamese: Evidence from task-oriented dialogues

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Abstract

In this paper we investigate the behaviour of the lexical rising tone (SAC) in disyllabic sequences in the Northern variety of Vietnamese. Results from task-oriented dialogues show that this rising tone (SAC), when occurring before the lexical high-level tone (NGANG), can be realised as low level or falling, resembling a different tone in the language (HUYEN). This is the case word-internally and within noun phrases. Two further observations give us an indication that a sandhi process could be developing: (a) this variation is not found in sequences across a larger juncture, and (b) the SAC tone does not undergo this change before other tones.

Index Terms: Northern Vietnamese, tone sandhi, neutralisation, disyllabic sequences, semi-spontaneous speech

1. Introduction

Tone sandhi is a well-known phenomenon in a number of East Asian tone languages such as Taiwanese, Cantonese, Mandarin and other Chinese dialects. It involves ‘phonological changes that take place across word boundaries’ or ‘systematic tone changes, even when they take place word-internally across morpheme boundaries’ [1:180]. Examples are *third tone sandhi* in Mandarin Chinese [2], *Min tonal circle* in Taiwanese [2], and *changed tone* in Cantonese [3]. This paper is concerned with the Northern variety of Vietnamese.

Northern Vietnamese has six lexical tones, two of which are level, high (NGANG) and low (or low-falling) (HUYEN), and four of which are contour tones, rising (SAC), falling-rising (HOI), rising-glottalised (NGA), and falling-glottalised (NANG). There is no established tone sandhi in this language, apart from tonal harmony processes in reduplication contexts [4], also referred to as tonal alternation [1]. Moreover, tonal coarticulation has been attested at a phonetic level [5]. However, although sandhi has not been found in controlled experiments, we have informally observed some allophonic variation in conversational speech in younger speakers, more specifically, in disyllabic words, in which the first syllable has a rising tone (SAC) and the second a high level tone (NGANG). In these words the first syllable appears to have a low level or falling pitch, akin to another tone in the language, HUYEN.

Such a change cannot be accounted for by coarticulation, there being no coarticulatory pressure to change a rise before a high-level tone into a fall. However, since this allophonic variation has been observed in spontaneous speech, this study is based on a task that ensures that speakers are formulating their utterances without an orthographic prompt, and that they are interacting with an interlocutor.

We focus in particular on disyllabic sequences within non-reduplicated words and noun phrases. Our specific research questions are whether in conversational speech in the laboratory we obtain 1) a low level or falling allophone of the

rising tone (SAC) when produced before the high-level tone (NGANG) and, if this is the case, 2) whether the allophonic variant of SAC resembles the low-level/falling tone HUYEN.

Below we first present an overview of the methodologies used in the elicitation and analysis (section 2). Then we investigate the shape of tone SAC before tone NGANG in sequences with weak junctures against those with larger junctures (section 3.1). In section 3.2 SAC NGANG sequences with weak junctures will be compared with sequences where SAC precedes other tones with comparable junctures. Section 3.3 presents the shape of tone SAC in SAC NGANG sequences against the shape of tone HUYEN in HUYEN NGANG sequences. Conclusions and discussions are provided in section 4.

2. Methodology

2.1. Speech materials and participants

A map task dialogue was recorded using the methodology and design from the HCRC Map Task Corpus [6]. The reason for this choice is that map task dialogues provide real interaction between speakers and assure a certain degree of spontaneity of the data in which the sequences in question are produced.

Two participants have slightly different maps with 11 or 12 landmarks. Some of the landmarks are located differently. While only one map has a route from the start to the end, the other has only the start. The task is for one participant to instruct the other to reproduce the route on the second map without either seeing each other’s map. This is done by discussing the route and landmarks. A small screen was placed between the two participants to prevent eye contact. The total duration of the dialogue is approximately 10 minutes. Speaker L is from Thanh Hóa (female, aged 26), speaker M is from Tuyên Quang (female, aged 28). Both provinces are in the Northern Vietnam. The speakers are colleagues and have been living in Hanoi for 4 and 10 years respectively.

2.2. Data transcription and categorisation

The dialogue was orthographically transcribed to enable the selection of the sequences in question. Our target sequences are SAC before NGANG. To investigate the first research question of whether there is an allophonic variant of SAC before NGANG, we first looked at sequences with different syntactic junctures. Then the SAC-NGANG sequences were compared with sequences from a control group, SAC before tones other than NGANG (control group 1). To address the question of whether we are dealing with a sandhi process of SAC-NGANG changed to HUYEN-NGANG (research question 2) we took into account a control group of HUYEN-NGANG sequences (control group 2). Sequences from both control groups had comparable juncture strength.

With respect to the target group, we found in total 75 SAC-NGANG sequences in the dialogue. These sequences were categorised according to their syntactic junctures. We found 4 groups of junctures: i) within disyllabic words, ii) across noun+modifier, classifier+noun, preposition+noun, and verb+object boundaries, iii) across subject+predicate boundaries, and iv) across a sentence boundary. In this paper we analysed only groups i), with the weakest juncture, and iv) with the strongest juncture, as they provide the most cases (in total **36 cases**). Table 1 provides an overview of these two groups of juncture, the frequency of the investigated cases and their syntactic junctures. Sequences that involved a self-repair, a hesitation, or a strong interaction with the intonation at the right edge of the utterances [7] were also excluded.

Table 1. *The frequency of occurrence and examples for each type of syntactic juncture for SAC NGANG sequences (word-for-word glosses in small capitals, corresponding translations in italics)*

Grp	Freq	Syntactic junctures and examples
1	19	disyllabic words phía trên SIDE TOP <i>above</i> , phía ngang SIDE CROSS <i>across</i> , trái tim heart, ngón tay finger
2	17	sentence+sentence (or fragment) or sentence+particle Không phải phía bên phải đâu nhớ NEG OUGHT SIDE SIDE RIGHT NEG PARTICLE <i>It is not on the right hand you know,</i> bên trái điếm-đến SIDE LEFT DESTINATION <i>on the left of the destination.</i> mình vẽ một nửa cái bán-cầu đấy WE DRAW ONE HALF CLF HEMISPHERE THAT thôi ONLY <i>We draw only half of that hemisphere.</i>
	$\Sigma=36$	

Table 2 provides examples for the target group of SAC-NGANG sequences (TG) and two control groups (CG), and the frequency of these sequences; control group 1 (SAC before other tones: SAC-OTHER) and control group 2 (HUYEN-NGANG) had comparable juncture strength.

Table 2. *Examples and frequency of sequences in the target group SAC-NGANG disyllabic words (TG) and 2 control groups (CG1: SAC-OTHER, CG2: HUYEN-NGANG) (word-for-word glosses in small capitals, corresponding translations in italics)*

Grp	Freq	Examples
TG	19	phía trên SIDE TOP <i>above</i> , phía ngang SIDE CROSS <i>across</i> , trái tim heart, ngón tay finger
CG		
1	44	uốn lượn <i>to curve</i> , cánh đồng <i>field</i> , nối thẳng <i>link directly</i>
2	16	đầu tiên <i>firstly</i> , vòng qua <i>go round-to</i> , rồi xong <i>then</i>
	$\Sigma=79$	

2.3. Acoustic analysis

To quantify the shape of the contour on SAC syllables, we first extracted the F0 values and calculated the distance between the F0 at the vowel onset and the value at the end of the syllable. The measurement at the vowel onset is chosen to minimize effects of microprosody due to onset consonants on SAC syllables. If the values of this measure are positive, this indicates that SAC has a rising contour. If the values are negative or zero, it is an indication that SAC is falling or level. This step was conducted, not only for the target sequences SAC-NGANG, but also for the two control groups SAC-OTHER (control group 1) and HUYEN-NGANG (control group 2). All measurements were conducted using Praat.

3. Results

3.1. SAC-NGANG sequences across junctures

We examined whether the juncture strength between the two syllables in SAC-NGANG sequences affects the realisation of the SAC tone by comparing the interval in semitones between the beginning of the vowel and the end of the SAC syllable in the two different juncture conditions. Values for each of the juncture conditions are plotted individually for each speaker in Figure 1.

SAC-NGANG sequences across junctures (speakers L/M)

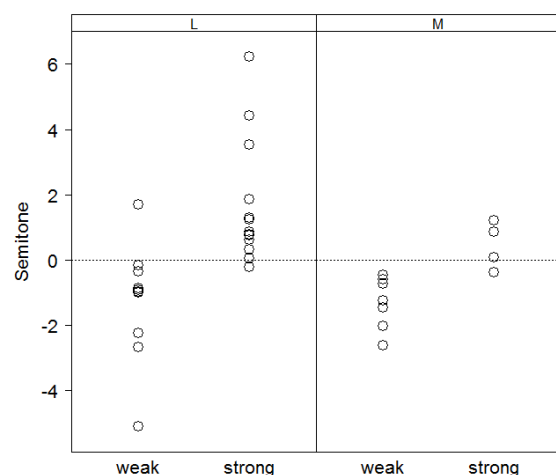


Figure 1: *Distribution of intervals in semitones between vowel onset and end of syllable for the initial syllable with rising tone (SAC) in SAC-NGANG sequences across two juncture strengths. Negative values=falling, positive values=rising; speaker L: weak juncture (N=12), strong juncture (N=13); speaker M: weak juncture (N=7), strong juncture (N=4).*

Here we can see that there is little overlap across the two juncture strengths in the realisation of SAC in SAC-NGANG. Specifically, we can observe a great number of low level or falling realisations (indicated by negative values or values around 0st) and very few rising realisations of the rising (SAC) tone (indicated by positive values) when the juncture is weak. Both speakers show the same tendency. Their roles in

the task (speaker L being instruction giver, speaker M being follower) resulted a greater number of utterances for L than M. The investigated sequences occur in both phrase-medial and phrase-final positions indicating that SAC is changed before NGANG regardless of the position of the sequences in phrases. When the juncture was strong, by contrast, there were predominantly rising realisations, i.e. the tone was realised in its canonical form as in citation contexts.

Figure 2 shows two examples of the contour on SAC in SAC-NGANG sequences produced by speaker L. The first sequence is the word “phía ngang” (Fig. 2a) *across* taken from the utterance:

Không đi lên đầu mà đi **phía ngang**.
 NEG GO UP NEG BUT GO SIDE CROSS
Don't go up but go across.

The second sequence (Fig. 2b) has a strong juncture between the two syllables, namely between a sentence and a fragment:

xong vòng lên trên bệnh-viện **nhớ**,
 THEN CIRCLE UP ABOVE HOSPITAL IMP.PARTICLE
lên trên nóc bệnh-viện ý
 UP ABOVE TOP HOSPITAL PARTICLE

Then go up to the hospital, up to the top of that hospital.

We see that in the first case, the contour on the SAC syllable is falling, whereas the contour in the second one has a rise similar to the lexical tone of the particle.

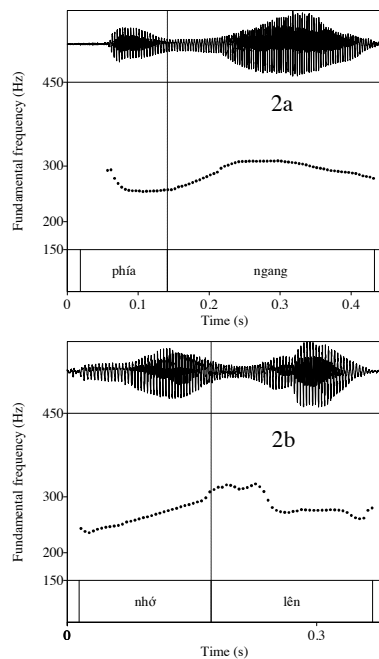


Figure 2: Examples of the contour of SAC before NGANG in a compound (2a) and in a sequence with a strong juncture between the two syllables (2b). Dotted line shows the boundary between the two syllables.

3.2. SAC NGANG vs. SAC OTHER sequences

The question that arises is whether, in cases of weak juncture, SAC tends to be produced as falling or level before only the tone NGANG or whether it also has this tendency before other tones. Figure 3 shows the interval in semitones between the vowel onset and end F0 in SAC syllables in SAC-NGANG sequences and SAC-OTHER sequences (all with

weak junctures, see Table 2). Almost all values for SAC in SAC-NGANG are negative or at the 0 level, showing that the contours on SAC in these sequences are falling or level. By contrast, the values for SAC in SAC-OTHER sequences are almost all positive, showing that the contours on SAC syllables are rising. Again, both speakers show the same tendency. These results provide evidence of an allophonic variation of SAC when occurring before NGANG: in SAC-NGANG compounds or sequences with minimal junctures, SAC appears to have a falling or level contour, whereas in SAC-OTHER sequences with comparable junctures, tone SAC has a rising contour.

SAC-NGANG vs SAC-OTHER sequences (speakers L/M)

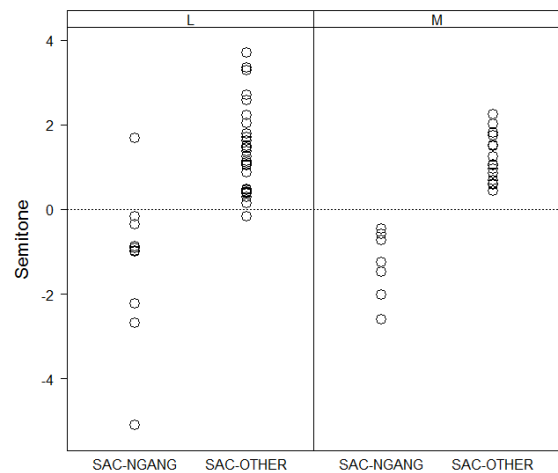


Figure 3: Distribution of intervals in semitones between vowel onset and end of syllable for the initial syllable with rising (SAC) tone in SAC-NGANG sequences (speaker L, N=12; speaker M, N=7) and SAC-OTHER sequences (speaker L, N=28; speaker M, N=16).

3.3. SAC NGANG vs. HUYEN NGANG sequences

So far, we have provided evidence of the tone SAC being produced as low level or falling before the tone NGANG. We compared this tone with the lexical low-level/falling tone HUYEN in the sequences HUYEN-NGANG. Figure 4 shows the intervals in semitones between the vowel onset and end F0 in SAC syllables in SAC-NGANG sequences and in HUYEN in HUYEN-NGANG sequences (again, all with weak junctures, see Table 2). Since speaker M only had one realisation of HUYEN-NGANG, we considered only the data of speaker L. The figure shows that a great deal of the intervals have negative values showing that the contours of both tones are falling or level. This indicates that tone SAC produced by speaker L resembles tone HUYEN when they precede tone NGANG.

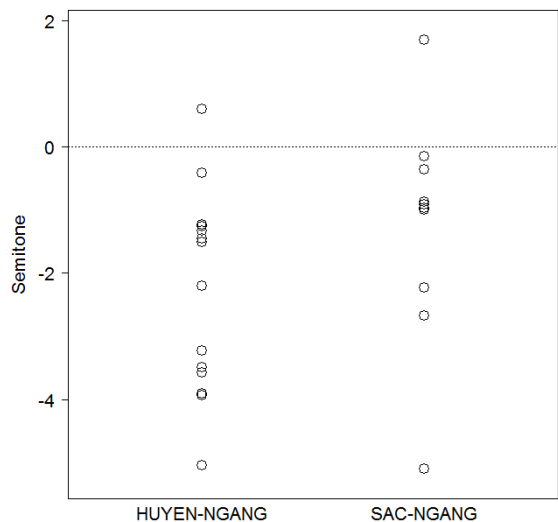
SAC-NGANG vs HUYEN-NGANG sequences (speaker L)

Figure 4: Distribution of intervals in semitones between vowel onset and end of syllable for the initial syllable with rising (SAC) tone in SAC-NGANG sequences ($N=12$) and for the initial syllable with low-level/falling (HUYEN) tone in HUYEN-NGANG sequences ($N=15$).

4. Discussion and Conclusion

In this study we found that in disyllabic words and within noun phrases the lexical rising tone (SAC) is realised as falling or level when occurring before the lexical high-level tone (NGANG). This tendency does not hold when there is a strong juncture between the two syllables, such as the juncture between two sentences or between phrases and particles. Furthermore, the rising tone (SAC) rarely changes before other tones, suggesting an allophonic variation of SAC before NGANG. The comparison of the rising tone (SAC) and the low-level/falling tone (HUYEN) before NGANG shows that these two tones resemble each other, confirming our informal observation that SAC might be neutralised to HUYEN when preceding NGANG in disyllabic words and within noun phrases. Here we only considered the first syllable in the sequences, but our results suggest that SAC may leave residual cues on NGANG for at least one speaker (L). A corpus controlled in terms of possible microprosodic effects is needed to investigate these possible residual cues. Nonetheless, the type of change on the first syllable of the sequence - from rising to falling before a high tone on the second - cannot be accounted for by coarticulation.

Historically, tone sandhi often originates from allophonic variants of tones [cf. 8]. Thus, there might be an emerging sandhi process of SAC changed to HUYEN when preceding NGANG in certain varieties of Northern Vietnamese. Although our speakers, L and M, come from provinces outside of Hanoi, they have been living in the capital for quite a long time (4 and 10 years respectively). It is so far unclear whether this variation of SAC before NGANG is restricted to Hanoi, and that our speakers have adapted this trend, or whether it is more geographically widespread.

Another issue that needs to be addressed is the question whether the neutralised SAC tone is comparable to the neutral tone in Mandarin Chinese [9]. Our data suggests that this is

probably not the case, as we found the change of tone SAC not only in disyllabic sequences involving function words (e.g. classifiers) but also in disyllabic words. Tone SAC appears in these sequences to be comparable to tone HUYEN, rather than seemingly targetless or with a neutral mid target [9].

Further investigations will look at the second syllable (NGANG) and expand the corpus to include speakers of different ages and different speaking styles. Moreover, perception tests are necessary to ascertain whether listeners can actually distinguish between SAC and HUYEN before NGANG. These will help us understand the nature and extent of the allophonic variation and whether we are indeed dealing with an emerging sandhi process.

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6. References

- [1] Yip, M. (2002): *Tone*. Cambridge: CUP.
- [2] Chen, M. (2000): *Tone sandhi: patterns across Chinese dialects*. Cambridge: CUP.
- [3] Yu, Alan C. L. (2007). Understanding near mergers: The case of morphological tone in Cantonese. *Phonology* 24 (1): 187–214.
- [4] Pham, A. H. (2002): *Vietnamese Tone. A New Analysis*. New York & London: Routledge.
- [5] Brunelle, M. (2009): Northern and Southern Vietnamese tone coarticulation: A comparative case study. *Journal of the Southeast Asian Linguistics Society* 1:49-62.
- [6] Anderson, A., Bader, M., Bard, E., Boyle, E., Doherty, G. M., Garrod, S., Isard, S., Kowtko, J., McAllister, J., Miller, J., Sotillo, C., Thompson, H. S. and Weinert, R. (1991). The HCRC Map Task Corpus. *Language and Speech*, 34, 351-366.
- [7] Brunelle, M. & Hà, K. P. & Grice, M. (2012): Intonation in Northern Vietnamese. *The Linguistic Review*, 29(1):3-36.
- [8] Gussenhoven, C. (2004): *The phonology of tone and intonation*. Cambridge: CUP.
- [9] Chen, Y., & Xu, Y. (2006). Production of weak elements in speech: Evidence from neutral tone in Standard Chinese. *Phonetica* 63: 47-75.