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ACOUSTIC CORRELATES OF STATEMENT AND QUESTION INTONATION IN SOUTHERN VIETNAMESE

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Abstract
This paper reports a study that investigated the acoustic correlates of the intonation patterns of statements versus various kinds of questions in Southern Vietnamese. Sentences identical in segmental make-up and lexical tone were elicited in nine different contexts: (1) statements, (2) Yes-No questions without particles, (3) Yes-No questions with the particle *không*, (4) questions with the particle *ư* (5) alternative questions with the particle *hay* 'or', (6 and 7) Wh-questions with the particles *ai* (who) and *chừng nào* 'when' at the beginning, and (8 and 9) Wh-questions with particles *cho ai* 'for whom' and *hồi nào* 'when' at the end. Twenty speakers (9 males and 11 females) from Hồ Chí Minh City participated in the study. The results show that there are a number of acoustic strategies for realizing the difference between declaratives and the interrogatives in Southern Vietnamese: global F0, speech tempo, intensity and local sentence-final F0. The results of this investigation contribute to the study of Vietnamese prosody, cross-language and cross-dialectal prosodic comparison.

Keywords: declarative, interrogative, intonation, acoustic phonetics, Southern Vietnamese
ISO 639-3 codes: vie

1. Introduction

The difference between declarative and interrogative intonation has been studied a great deal since 1950 by many linguists, but agreement on this question has not yet been reached (Zeng, Martin and Boulakia 2004). In English as well as many other non-tonal languages, interrogative intonation, particularly yes-no questions, has a rising pitch contour, whereas declarative intonation has a falling pitch contour. This phenomenon has been widely studied and was generalized as the Strong Universalist Hypothesis (Ladd 1981), according to which rising pitch indicates a question and falling pitch indicates a statement. These tendencies can also be explained as soft universals: the Frequency and the Effort Codes (Ohala 1983; Gussenhoven 2004). In a tone language such as Chinese or Vietnamese, however, the difference between declarative and interrogative intonation is much more complicated because of tone and intonation interaction. For example, a sentence with an interrogative intonation ending in a final rising tone has a rising end, which is similar to English, whereas an interrogative sentence with a final falling tone often has a falling end (Yuan, Shih and Kochanski 2002). Studies in Chinese intonation show that the diverse surface patterns can be accounted for by two consistent features: (1) Interrogative intonation has a higher phrase curve than declarative intonation; (2) Sentence final syllables have more careful intonation and wider pitch swings in interrogative sentences (Yuan, Shih and Kochanski 2002; Zeng, Martin and Boulakia 2004).

In Vietnamese, previous studies have shown that there are a number of acoustic correlates for realizing sentence modalities, predominantly based on global F0 and intensity and local sentence-final F0 (Trần 1967; Đỗ et al. 1998; Nguyễn and Boulakia 1999; Vũ et al. 2006; Brunelle, Ha and Grice 2012). It has been found that declaratives tend to have a slight overall F0 declination (Đỗ et al. 1998; Nguyễn and Boulakia 1999). Interrogatives are found to have a high overall range (Hoàng 1985), or a high range and a rise starting much before the sentence final question marker (Đỗ et al. 1998; Nguyễn and Boulakia 1999). However, one study suggests that the range difference between statements and questions is insignificant and that the rise of the questions is largely located towards the end of the sentence-final question particle (Vũ et al. 2006). In a recent study, Brunelle, Ha and Grice (2012) look at the role of intonation in the realization of communicative functions in Northern Vietnamese. Their results show that there are a number of acoustic strategies for realizing communicative functions, predominantly based on global F0 and intensity and local sentence-final F0. Nevertheless, the acoustic properties associated with communicative functions are variable, or even absent in individual speakers.

In regard to duration, it is found by Nguyễn and Boulakia (1999) that interrogatives have a shorter duration than declaratives. Imperatives are also described as having a high overall F0 (Hoàng 1985), possibly with an additional final rise (Đỗ *et al.* 1998) and a longer duration (Trần 2007). However, they do not rise as high as interrogatives, and are claimed to have a higher intensity than declaratives (Nguyễn and Boulakia 1999). Studies on emphatic rendering of speech also find raised F0 and intensity, but no significant changes in voice quality (Michaud and Vũ 2004; Michaud 2005).

Generally, the results of studies in Vietnamese indicate that global pitch properties, overall trends in the F0 or F0 range, convey sentence modes. Local pitch effects, such as a final rise in questions, have received less attention and only recently been investigated by Brunelle, Ha and Grice (2012) for Northern Vietnamese. In a recent study, Brunelle (2016) used an eight-hour corpus of Southern Vietnamese spontaneous speech as a basis for investigation of intonation. The results showed that just as in Northern Vietnamese, there is little evidence for strongly phonologized boundary tones in Southern Vietnamese. The two systematic intonational patterns uncovered in this study, a higher F0 in the final syllable of exclamatives and emphatics, and a lower F0 in backchannel utterances, could both be attributed to a weak effect of a universal effort code (Nespor and Vogel 1986; Selkirk 2011) rather than to phonological targets.

The modest aim of this paper is to provide a descriptive analysis of the acoustic correlates of the intonation patterns of statements versus various kinds of questions in Southern Vietnamese. This study is different from previous studies in several ways: (1) while previous studies employed Northern Vietnamese speakers, this study focuses on the Southern dialect (Saigon speakers); a very first study of intonation in Southern Vietnamese was by Trần (1967) which was based on auditory observation ; (2) while previous studies concentrate on the comparison of the intonation of statement and Yes-No question, this study includes different types of questions such as Yes-No questions with and without the particle *không*, 'or' questions with the particle *hay* [or] and Wh- questions with the particles not only at the beginning (*ai* 'who' and *chừng nào* 'when') but also at the end of the questions (*cho ai* 'for whom' and *hồi nào* 'when').

Vietnamese is a tonal language. Standard Northern Vietnamese has six different tones comprising *ngang* (level tone), *huyền* (falling tone), *hỏi* (curve tone), *ngã* (broken or creaky tone), *sắc* (rising tone), and *nặng* (dropping tone) (Đoàn 1999; Đinh and Nguyễn 1988; Vũ 1981). Every word is marked with a tone, and differences in tone lead to changes in the meaning of a word. In the Southern Vietnamese tone system there are just five tones: *level, falling, broken-curve, rising,* and *dropping* (Đinh and Nguyễn 1988; Brunelle 2009a; 2009b). Two additional tones are found in checked syllables (i.e. syllables closed by voiceless stops), but will not be dealt with here.

According to Vũ (1981) and Phạm (2003), the acoustic and perceptual correlates of Vietnamese tones include the direction of pitch (F0) movement, pitch height and voice quality, which play a more important role than other tonal dimensions, such as duration and intensity, in the identification of Vietnamese tones. According to Vũ (1981), Brunelle (2009) and Kirby (2010), the Southern Vietnamese are purely pitch-based, while the Northern Vietnamese are cued by a combination of pitch and voice quality. Southern Vietnamese speakers may mimic Northern Vietnamese voice quality distinctions in certain situations, but colloquial Southern Vietnamese speech does not make contrastive use of distinctive voice quality.

While the *level* (*ngang*), *falling* (*huyền*), and *rising* (*sắc*) tones in Southern Vietnamese are nearly identical to their Northern Vietnamese counterparts, the realization of the *hỏi* (curve tone), ngã (broken tone), and *nặng (dropping tone)* is rather different. The contour tones *hỏi* (curve tone) and ngã (broken

tone) have merged in Southern Vietnamese into a single tone with a falling-rising pitch contour and little to no trace of laryngealization (Brunelle 2009; Kirby 2010). The Southern Vietnamese *nặng* tone (dropping tone) has a similar type of pitch excursion, although its final rise is less extreme. In contrast to the Northern Vietnamese low *nặng* tone, which is short and marked by strong final laryngealization, the Southern Vietnamese *nặng* tone lacks any laryngealization, and, perhaps as a result, has a longer average duration compared to its Northern Vietnamese counterpart (Kirby 2010).

2. Methods

2.1. Linguistic materials

In order to pursue the aim of this study, we constructed a data set made up of sentences that are strictly controlled for their segments, tones and syntactic structures, and in which all five lexical tones in Southern Vietnamese were tested. Sentences identical in segmental make-up and lexical tone were elicited in nine different contexts: (1) statements, (2) Yes-No questions without particles, (3) Yes-No questions with the particle *không*, (4) questions with the particle *ư* (5) alternative questions with the particle *hay* (or), (6 and 7) Wh-questions with particles *ai* 'who' and *chừng nào* 'when' at the beginning, and (8 and 9) Wh-questions with the particles *cho ai* 'for whom' and *hồi nào* 'when' at the end. They were all composed of root SVO clauses made up of six, seven or eight words/syllables. Each context has five tones and each tone has two sentences: 9 contexts x five tones x 2 sentences = 90 sentences. A complete list of the sentences is presented in Appendix 1. It is noted that the mixing of diacritics in sentences 9 and 10 is fine because these tones are merged in this dialect.

2.2. Participants

The participants included 20 Southern speakers (9 males and 11 females) from Hồ Chí Minh city. Their age ranges from 23 to 45. They were students and teaching staff at University of Social Science and Humanities of Hồ Chí Minh City, Vietnam. Most of them were born in Hồ Chí Minh city, while six were born in neighbouring provinces in the Mekong Delta, but they grew up in Hồ Chí Minh City. The details of the speakers' backgrounds (e.g. their and their parents' place of birth, etc.) are provided in Appendix 2.

2.3. Procedures

The 90 sentences used for elicitation purposes were presented to the subjects in print. Before the recording, they had time to become familiar with the sentences. The subjects were asked to speak the sentences to the first researcher in a quiet room. They first spoke the ten declarative sentences to the researcher, one by one. Then they asked the researcher the remaining 80 questions. Each sentence was spoken only once by a speaker. We assume that after being familiar with the sentences, the subjects would speak them more naturally. Since the meanings of these sentences were straightforward, without any ambiguity on their own, there was no need for context sentences preceding them, as in the case of Brunelle, Ha and Grice (2012). The questions without particles that were exactly the same as the corresponding statements in terms of segmental and tone makeup were presented with a question mark at the end, while all other questions types have question words/particles, also having a question mark at the end. It is noted that questions without particles is possible in Vietnamese, but the occur less frequently than questions with particles, so they can be considered 'marked'.

The sentences were recorded at 44.1kHz using the built-in microphone of a laptop and the Praat software (Boersma and Weenink 2010). A native listener (the second author) was then asked to rate the naturalness of the 1,800 recorded sentences, and those that were judged unnatural (28/1800 sentences or 1.5 %) were excluded from the analysis.

It is noted that given the conditions in which data is presented, the difference between declaratives and interrogatives was obvious to the speakers. Thus, we would expect a maximally contrastive intonation. Furthermore, since the declaratives are all read before the interrogatives, any durational effects found in interrogatives may be affected by increased familiarity with the experiment conditions.

2.4. Analysis

Sentences produced by the speakers were acoustically processed and analyzed in Praat (Boersma and Weeninck 2010). Each sentence was segmented into words and a script was used to extract the duration, the intensity and F0 at five equidistant points in each word. Results were visually inspected for F0 doubling and halving: suspicious values were simply excluded.

In order to present acoustic tonetic properties of tones in a tonal language and to avoid certain between-speaker differences in acoustic properties of voice signals due to speaker's vocal tract anatomy and physiology, it is necessary to use a method of normalisation to retain only the linguistic content of speech signal and exclude individual content (Rose 2000). The formula used for F0 normalisation in this study was the *Z*-score transform, which has been shown to be more effective than other forms of F0 normalisation in a tonal language (see Rose 1987):

$$F0norm = (F0i - \bar{F0})/s$$

where *F0norm* is the normalised F0 value expressed as a multiple of some standard deviations (*s*) above or below the mean F0 ($\bar{F0}$), and *F0i* is the F0 value to be normalised. The normalised F0 values of each tone for all subjects were then used to calculate mean normalised F0.

It has also been shown (Rose 1993) that it is important for linguistic tonetic comparison to retain information on relative tonal duration, so the duration values were normalised as a percentage of a speaker's mean duration value calculated from all tones. For example, if a speaker's mean duration was 41.07 csec, the normalised value for his level tone duration of 43.8 csec was ((43.8/41.07) x 100 = 107%. Figures 2, 4 and 5 show the results of mean F0 and duration normalisation across male and female speakers (9 males and 11 females).

In order to account for the effect of speakers' differences and the intrinsic segmental and tonal effects, a restricted maximum likelihood (REML) applied to mixed effect model methodology was performed on the duration (ms), F0 values (Hz) at 5 points on a word/syllable, and intensity (dB) at 5 points on a word/syllable. The fixed effects included contexts (9 contexts), tones (5 tones) and speakers (20 speakers). It is noted that speakers were used both as a fixed effect and a random effect. Thus, the random effects were speakers (20 speakers), sentences (1772 sentences=1,800-28 excluded sentences), and words (13,912 words). The use of REML overcomes the potentially serious deficiency of the ANOVA-based methods which assumed that data are sampled from a random population and normally distributed. REML also avoids bias arising from maximum likelihood estimators in which all fixed effects are known without errors and consequently tend to downwardly bias estimates of variance components. Moreover, REML can handle unbalanced data. The data analysis was carried out using the SPSS program. The results of the main effects and their interactions are reported in Appendix 3. Post-hoc tests by Fisher's Least Significant Difference (LSD) were used for pairwise comparison between contexts/sentence types and reported in Appendix 4. It is noted that that by not including random slopes, we get a model that is anti-conservative.

In addition, in order to examine the speaker variation effect, Post-hoc tests by Fisher's Least Significant Difference (LSD) were used for pairwise comparison between contexts/sentence types and speakers. Due to limited space of this paper, the result summary was discussed only in text form in section 3.5.

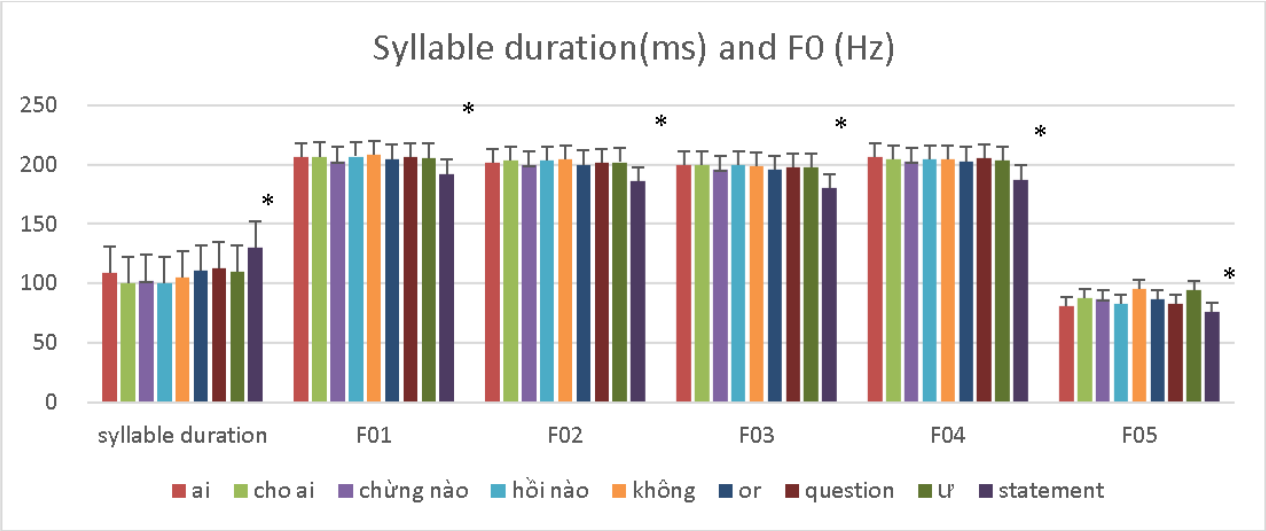
3. Results

3.1 Duration and F0

As shown in Appendix 3, the mixed effect model results on word/syllable duration and F0 values show significance for contexts ($p<0.001$), tones ($p<0.001$), speakers ($p<0.001$) and the interactions: *contexts x tones* ($p<0.001$), *speakers* x *tones* ($p<0.001$), *contexts x speakers* ($p<0.001$), while the three-way interaction effect *contexts* x *tones* x *speakers* does not reach a significant level. It is noted that the main effects of interest are contexts and *contexts* x *speakers* interaction while other factors (such as tones, speakers, *context* x *tones*, and *speakers* x *tones*) are merely intrinsic F0 and/or speakers' voice effects and thus will not be examined. The target main effect (i.e., contexts) is further examined in Figures 1 and 2. The target interaction effect (i.e., *contexts* x *speakers*) is examined in section 3.5.

Post-hoc analysis (Figure 1 and Appendix 4) shows that word/syllable duration of the statement is significantly longer than those of the eight question types while there was no significant difference in duration among the eight question types. By contrast, F0 values of the word/syllable of the statement is significantly lower than those of the eight question contexts, while there was no significant difference in F0 among the eight question types. It is noted that there are some significant differences between types of questions, but generally the pattern is not clear and the effect is not robust across the five data (F0 and intensity) points. Additionally, they are not of target interest (the main interest is between declaratives and all interrogatives) and thus they are not discussed. In addition, questions without particles and *chừng nào* questions are chosen for Figures 2 and 4 because all the words and tones in these two question types match well with those of the statements, which allows pair-wise word for word comparison.

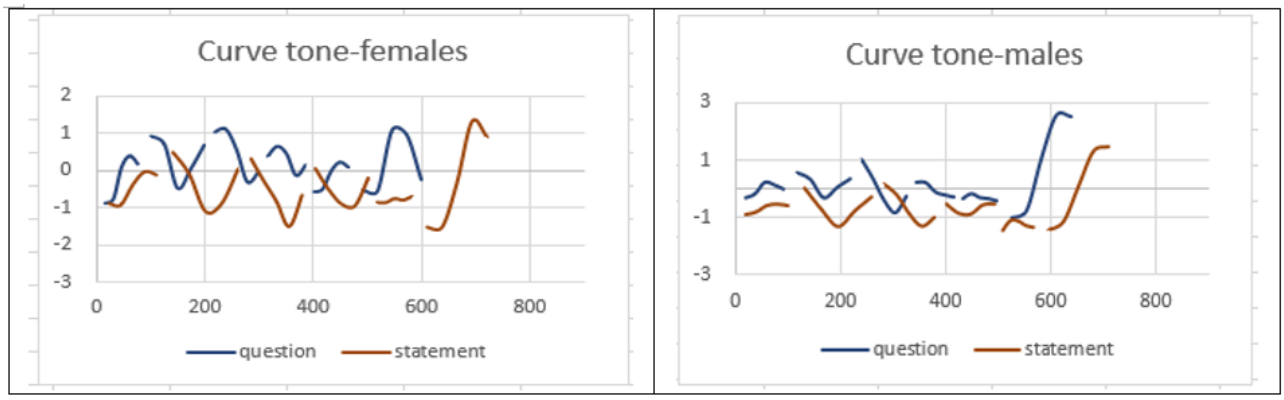
***Figure 1**. Mean of word/syllable duration (ms) and F0 values at 5 points on a word/syllables across 9 contexts. The symbol * means statements significantly different from eight question types at p<0.001.*



This result is further confirmed in Figure 2 that shows the tonal contours of the sentences in five tonal contexts. Generally, across five tones and two genders, the statements have lower F0 values than all of the eight questions. However, for clarity of illustration, we only present the tonal contour of the statement and the matching question without particle in Figure 2. By contrast, Figure 2 also shows that the questions and their individual syllables are shorter than those of the statements. In addition, it is also noted that sentence final syllables have fuller contours and wider pitch swings and/or heightened F0 end in interrogative sentences, particularly for level and falling tones, which normally have a falling end in statements.

***Figure 2**. Mean normalised tonal F0 for tones (in standard deviation (SD) unit on the X- axis) plotted as a function of normalised duration (% on the Y-axis) at 5 points on a word/syllable in statement versus question without particle across five tones and genders (11 females and 9 males)*

a. Level tones: Anh Tư đi mua hai cây lê 'Tu went to buy two pears.'
b. Rising tones: Chú Chín đến hái lá mía 'Uncle Chín comes picking sugarcane leaves.'
c. Falling tones: Bà Hồng trồng vài hàng ngò 'Mrs Hồng plants few rows of coriander.'
d. Dropping tones: Chị Dậu lượm một bị nặng 'Sister Dậu found a heavy bag.'
e. Curve tones: Hải Nhỏ gởi Thủy bảy tỉ 'Hải Nhỏ sent Thủy seven billion.'



3.2. Alternative questions

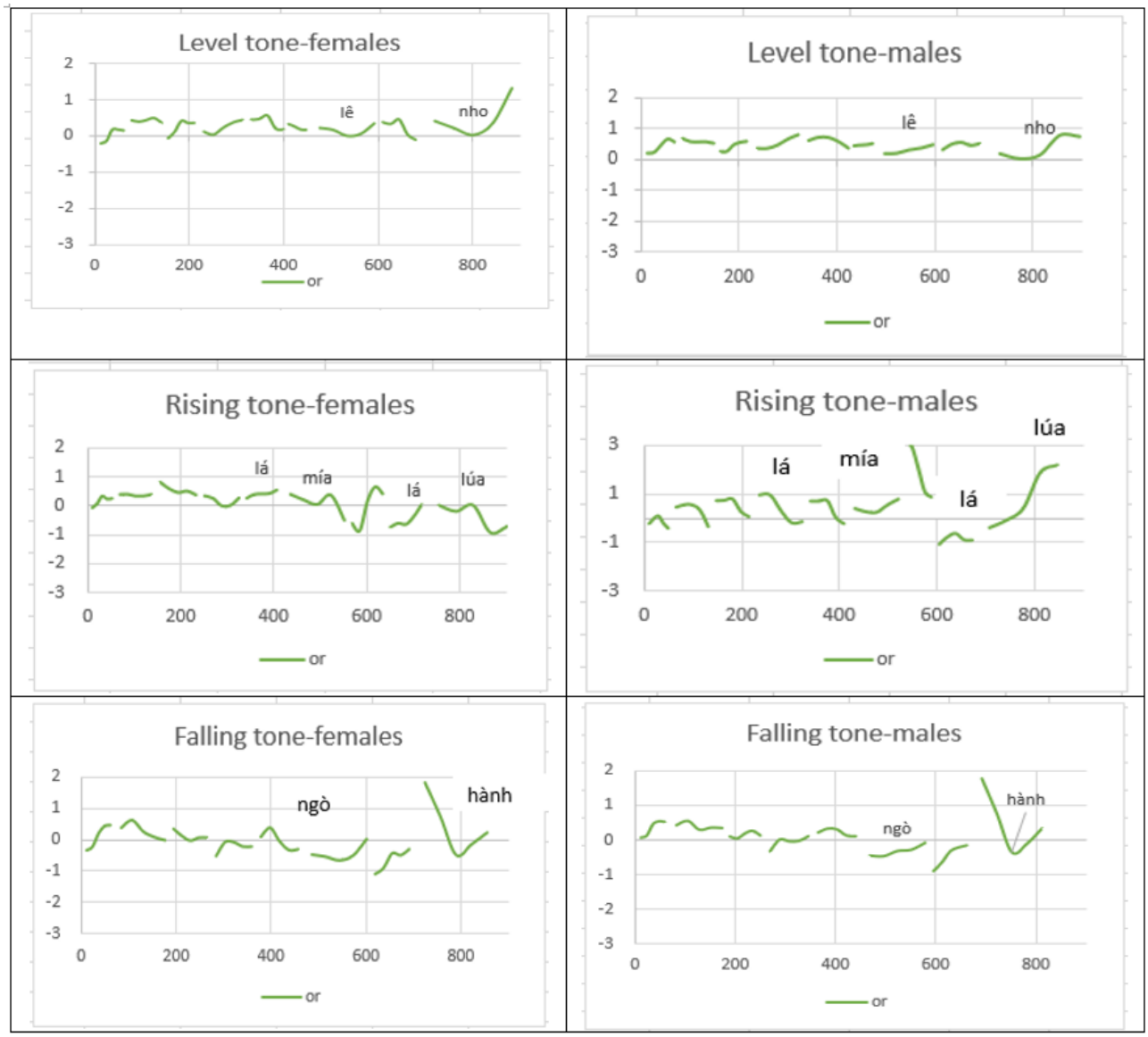
In order to examine the intonation patterns of alternative 'or' questions, we conducted a mixed effect model ANOVA analysis on the duration, F0 range (the tonal F0 max-F0 min) and mean intensity of the two target words in the or questions (the words/syllables before and after the particle *hay* 'or') as compared with other words/syllables in the questions. The fixed effect was word/syllable positions (three positions: the syllable before *hay*, the last syllable in the sentence (after *hay*), and other syllables in the sentence). The random effects were speakers (20 speakers), sentences (10 sentences) and words (1829 words/syllables). The results showed significant effects for duration ($F(2,139)=98$, $p<0.001$), F0 range ($F(2,81)=20$, $p<0.001$) and intensity ($F(2,133)=3.1$, $p<0.05$). Apart from the global F0 contours of the 'or' questions being higher than those of the statements, post-hoc comparison (Table 1 and Figure 3) showed that the words/syllables before and after the particle *hay* 'or') were lengthened, had larger F0 range and had fuller tonal shapes than the other syllables in the questions. The result on mean intensity only shows that the last words (after the particle *hay*) have lower intensity. This result suggests that 'or' questions are composed of two phrases which both have final lengthening (along with accompanying cues). The last syllable is even longer than the antepenultimate because it is in absolute final position.

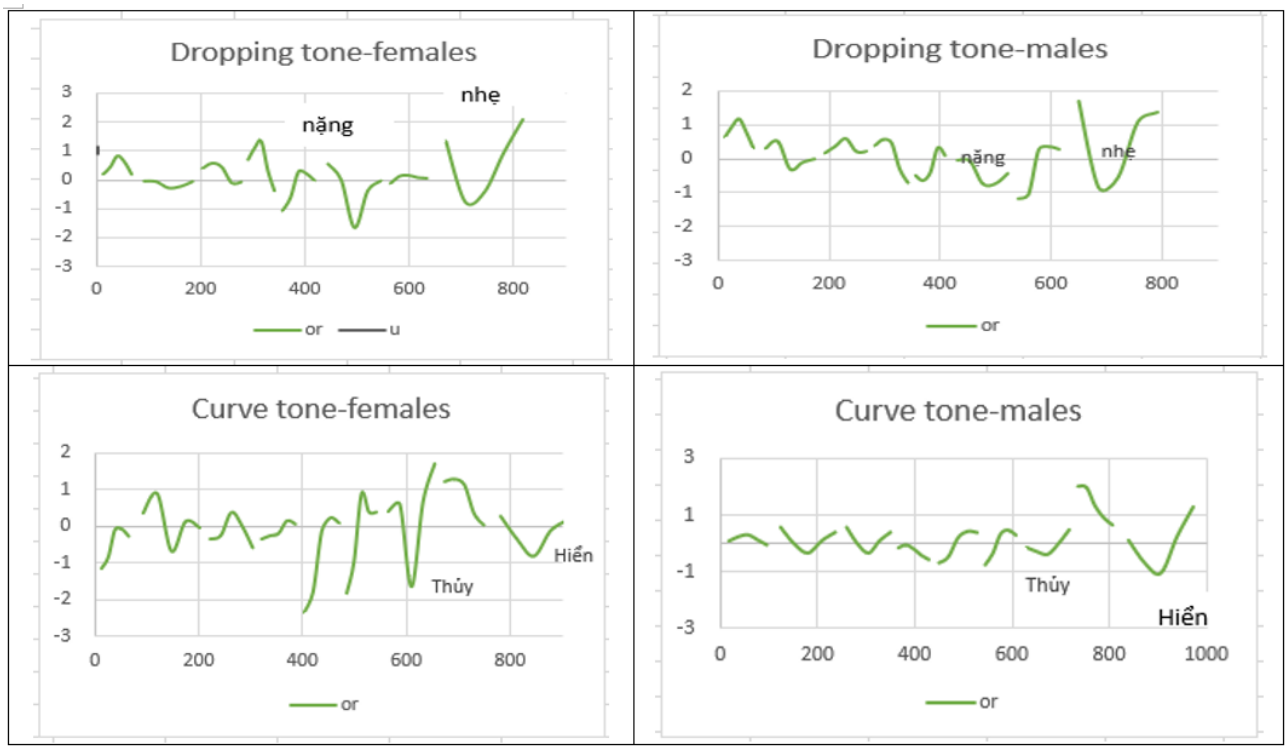
Table 1. *Mean duration (ms), F0 range (Hz) & intensity (dB) of the target words/syllables in 'Or' questions*

	Duration(ms)		F0 range(Hz)		Intensity(dB)	
	Mean	SE	Mean	SE	Mean	SE
Syllables in sentences	169.6	6.7	85.0	12.9	70.0	0.9
Syllables before OR (hay)	230.6	12.6	94.2	13.2	70.2	1.0
Final syllables (after OR (hay)	317.2	11.1	106.7	13.2	68.6	1.0

***Figure 3**. Mean normalised tonal F0 for tones (in SD unit on the X- axis) plotted as a function of normalised duration (% on the Y-axis) at 5 points on a word/syllables in 'or' questions across five tones and genders (11 females and 9 males)*

a. Level tones: Anh Tư đi mua hai cây **lê** hay **nho** 'Did Tu go to buy two pear plants or grape plants?'
b. Rising tones: Chú Chín đến hái lá **mía** hay lá **lúa** 'Did Uncle Chín come picking surgarcane leaves or rice leaves?'
c. Falling tones: Bà Hồng trồng vài hàng **ngò** hay **hành** 'Did Mrs Hồng plant few rows of coriander or spring onion?'
d. Dropping tones: Chị Dậu lượm một bị **nặng** hay **nhẹ** 'Did Sister Dậu find a heavy bag or light bag?'
e. Curve tones: Hải Nhỏ gởi bảy tỉ chổ **Thủy** hay **Hiển** 'Did Hải Nhỏ send seven billion to Thủy or Hiển?'





3.3. Wh-questions

Generally, the statistical analysis (Appendices 3 and 4) showed that the global F0 values of the words/syllables of the statements are significantly lower than those of all the Wh-questions, while there was no significant difference in global F0 among the Wh-question types. However, for clarity of illustration, we only present the tonal contours of the statements and the matching Wh- question with the particle *chừng nào* (when) in Figure 4. In addition, sentence final syllables are shown to have larger F0 range and/or heightened F0 end in the Wh-questions, particularly for the level and falling tones which normally have a falling end in statements.

To further investigate the phenomenon of heightened F0 end in questions, we inspected the F0 contours of sentences and counted the frequency of rising F0 at the end of the questions. The criteria for counting rising F0 end is a clear visible rising F0 movement with a minimum of 10Hz F0 rise at the end of the final words/syllables such as illustrated in Figure 5 The results are reported in Table 2. In addition, a precise quantification of F0 rise is also conducted by calculating F0 range of the final word (F0 end- F0 start). The results which show the mean F0 range and standard deviation by tones and genders are reported in Table 3.

As shown in Tables 2-3 and Figure 5, Southern speakers of Vietnamese tend to raise the F0 at the ends of questions, particularly final words/syllables. Nevertheless, it is subject to speaker variation: some speakers in the study produced the rising F0 end more often than the others. Generally, female speakers produced the rising intonation more frequently than male speakers. This tendency occurs not only in yes-no question without particles but also in all other kinds of questions with particles. As shown in Figure 6, the final words of the questions illustrated have the falling tone (i.e., *nào* and *ngò*), which should have a falling contour, but they were produced with a rising F0 end. It is also noted that there was no evidence of F0 rises at the end of declarative sentences across all speakers, which tend to have a slight final F0 declination, consistent with previous studies (Đỗ et al. 1998; Nguyễn and Boulakia 1999).

***Figure 4**. Mean normalised tonal F0 for tones (in SD unit on the X- axis) plotted as a function of normalised duration (% on the Y-axis) at 5 points on a word/syllables in statement versus Wh-question with the particle chừng nào across five tones and genders (11 females and 9 males).*

a. Level tones: Chừng nào anh Tư đi mua hai cây lê? 'When will Tư go to buy two pear plants?'
b. Rising tones: Chừng nào chú Chín đến hái là mía? 'When will Uncle Chín come picking sugarcane leaves?'
c. Falling tones: Chừng nào bà Hồng trồng vài hàng ngò? 'When will Mrs Hồng plant few rows of coriander?'
d. Dropping tones: Chừng nào chị Dậu lượm một bị nặng? 'When will Sister Dậu find a heavy bag?'
e. Curve tones: Chừng nào Hải Nhỏ gởi Thủy bảy tỉ? 'When will Hải Nhỏ send Thủy seven billion?'

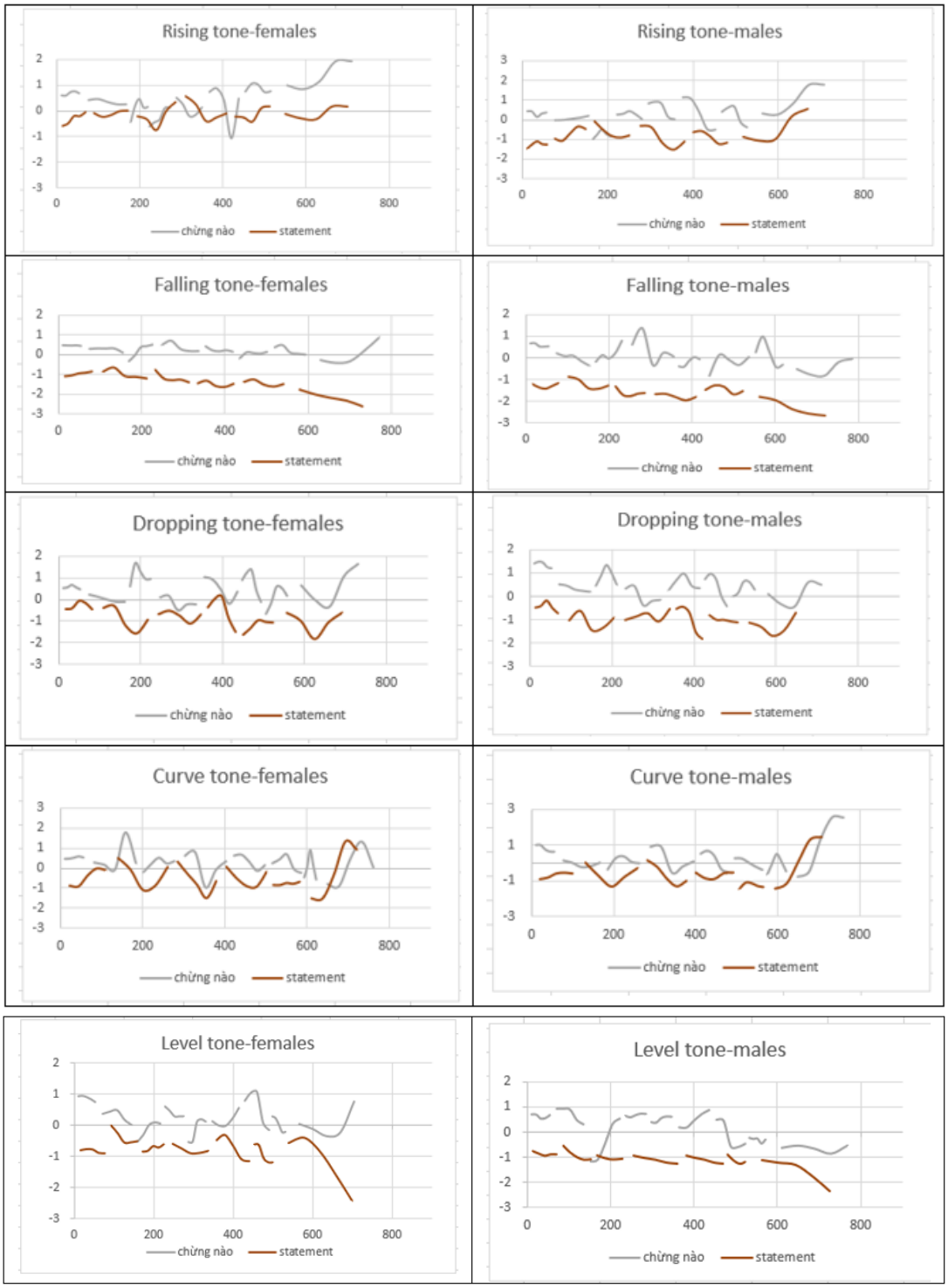


***Table 2**. Frequency of rising F0 end by speakers and question types*

M: male speakers, F: Female speakers. The total number of sentences per question type is four (for Yes-No questions without particles, alternative questions with the particle *hay*, Wh-questions with the particle *ai*, Wh-questions with the particle *chừng nào* because for the three tones (sac, hoi-nga and nang) a rise is expected anyway and thus these tones were excluded) and ten for the remaining question types.

Speakers	M1	M2	M3	M4	M5	M6	M7	M8	M9	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	**Total**
Yes-No questions without particles	4	1	4	3	1	0	1	1	1	0	4	4	3	4	1	0	4	4	4	4	**4**
Questions with the particle ư	9	3	9	10	6	3	8	6	8	7	8	10	10	6	7	0	8	4	10	9	**10**
Questions with the particle không	2	7	7	9	4	1	1	5	3	8	3	10	10	8	5	3	10	4	10	10	**10**
Or questions with the particle hay	4	3	4	3	1	0	0	0	1	0	2	4	4	4	1	2	2	2	4	3	**4**
Wh-questions with the particle ai	4	0	1	1	1	0	0	0	2	3	2	4	3	4	3	1	4	2	4	4	**4**
Wh-questions with the particle cho ai	4	0	6	0	3	0	8	0	0	7	7	10	0	10	7	7	7	6	10	10	**10**
Wh-questions with the particle chừng nào	3	2	4	0	1	0	4	0	0	2	3	4	4	4	3	0	2	1	4	4	**4**
Wh-questions with the particle hồi nào	10	8	10	0	5	0	0	0	0	1	10	10	3	10	0	9	10	0	0	10	**10**

***Figure 5**. Illustration of Rising F0 end in Falling tones at the end of questions.*

a. Anh Tư đi mua hai cây lê hồi nào 'When did Tư go to buy two pear plants?'
b. Bà Hồng trồng vài hàng ngò hồi nào 'When did Mrs Hồng plant few rows of coriander?'
c. Bà Hồng trồng vài hàng ngò 'Mrs Hồng planted few rows of coriander'

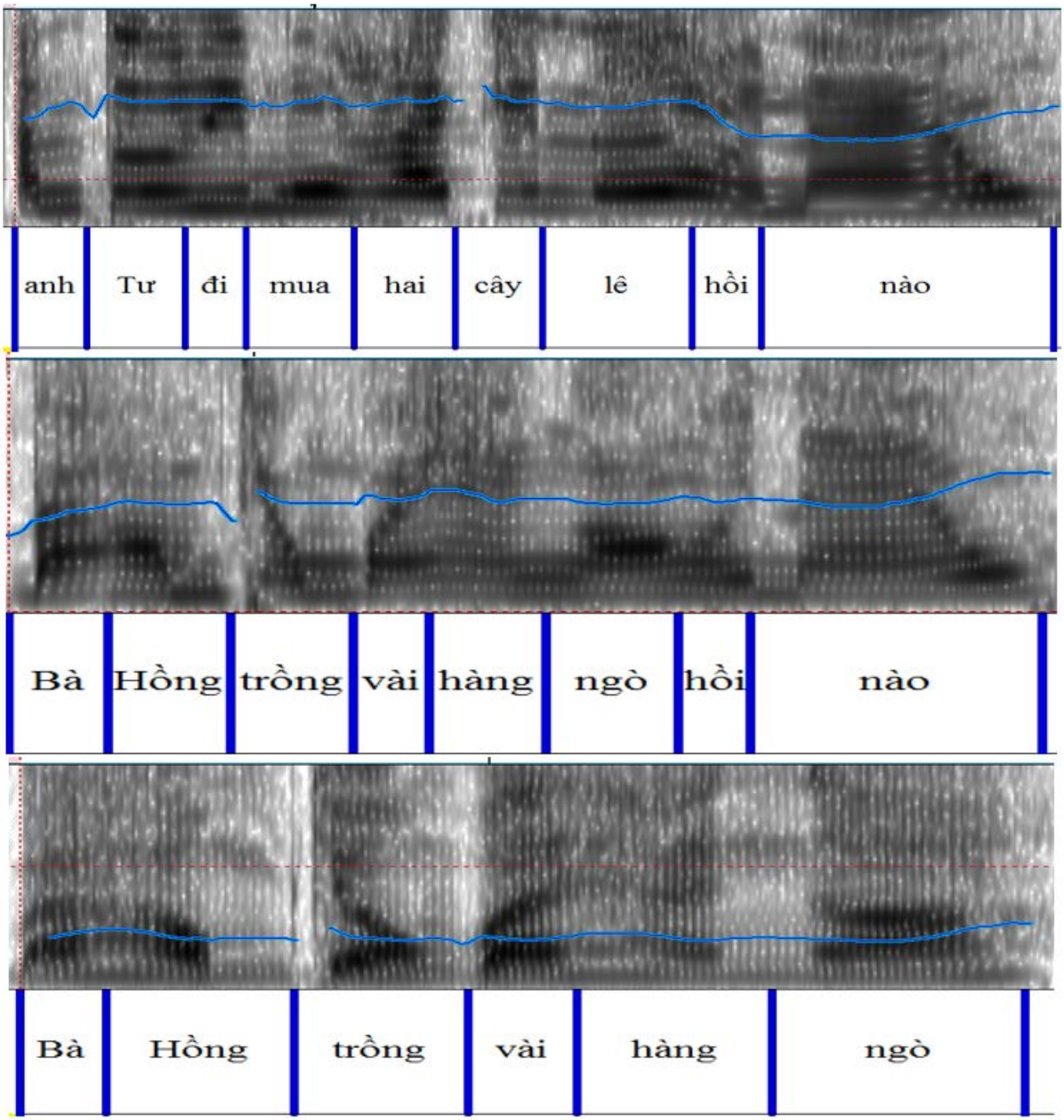


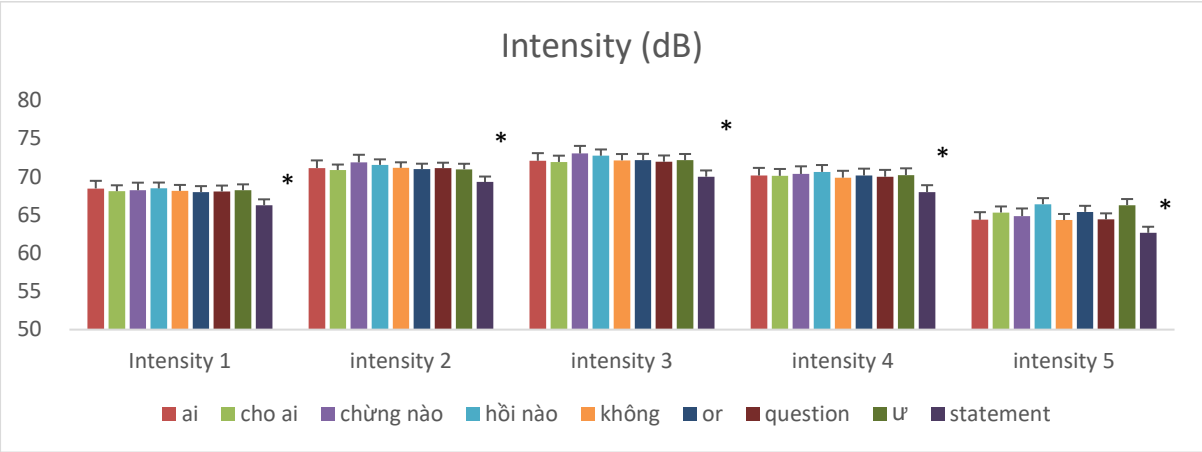
***Table 3.** Mean F0 range (Hz) and SD of final word/syllables of questions that have rising F0 endings by tones and genders*

Tones	Female		Male	
	Mean	*SD*	Mean	SD
Level	33.56	21.18	18.80	15.15
Falling	18.98	12.74	10.46	6.94
Dropping	33.15	20.02	17.45	12.71
Curve	72.46	30.60	63.82	27.26

3.4. Intensity

As shown in Appendix 3, the mixed effect model results on word/syllable intensity values show significance for contexts (p<0.001), tones (p<0.001) speakers (p<0.001) and the interactions: *speakers* x *tones* (p<0.001), *contexts* x *speakers* (p<0.001), while *contexts* x *tones* and the three-way interaction effect does not reach a significant level. As shown in Figure 6 and Appendix 4, intensity values of the words/syllables of the statement is significantly lower than those of the eight question contexts, while there was no significant difference in intensity among the eight question types.

***Figure 6**. Mean intensity values (dB) at five points on words/syllables across 9 sentence contexts. The symbol * means statements significantly different from eight question types at p<0.001.*



3.5 Speaker variation

The post-hoc pairwise comparisons among sentence types for individual speakers show that statements had significantly longer durations, lower F0 and intensity values than all types of questions across all speakers. The post-hoc significant levels ranged from p<0.05 to p<0.001. The significant effects are stronger for F0 and intensity (p<0.001-0.05) and less strong for duration by some speakers (p<0.05).

4. Discussion and conclusion

It is found in this study that communicative functions (i.e., declarative vs. various interrogative forms) are conveyed by the global values of the three acoustic correlates: duration, F0 and intensity. First, the F0 height of the entire sentence is affected (mean F0 being lowest in statement and higher in all forms of questions). This is consistent with findings from previous studies (Hoàng's 1985; Nguyễn and Boulakia 1999; Brunelle, Ha and Grice 2012). Nevertheless, in Brunelle, Ha and Grice, (2012), this strategy is subject to a great degree of speaker variation: only five speakers in their study show a higher overall range in interrogatives than in corresponding declaratives, while the effect is robust across genders and all speakers in this study. Second, compared to statements, questions are characterised by a faster speed, which is also a strong effect across all speakers, supporting results by Nguyễn and Boulakia (1999). Nevertheless, since the interrogatives in this study always followed declaratives in the wordlist, durational effects found in interrogatives may be partially affected by increased familiarity with the experiment conditions. Third, the intensity of the entire sentence is found to be raised in questions across all 20 speakers, in line with the findings by Brunelle, Ha and Grice (2012).

In addition to the global F0 differences between declarative and interrogatives, local F0 and duration effects are also found. First, final syllables are longer, have fuller contours, wider pitch swings and/or heightened F0 end in interrogative sentences. In particular, heightened F0 end is found for level and falling tones in questions which normally have a falling end in statements. Second, in 'or' questions, the words/syllables before and after the particle *hay* 'or' are lengthened, have larger F0

range and have a fuller tonal shape than the other syllables in the questions. In particular, dropping and curve tones of the target words/syllables have wider pitch swing: it falls deeper and rises higher. These local effects are consistent with findings in previous studies on Vietnamese (Đỗ et al. 1998; Nguyễn and Boulakia 1999; Vũ et al. 2006; Brunelle, Ha and Grice 2012) and Chinese – another tone language (Yuan, Shih and Kochanski 2002; XiaoLi, Martin and Boulakia 2004). Nevertheless, these local effects are no more than final-lengthening along with accompanying cues and have less to do with intonation per se such as in Western languages.

Furthermore, the presence of a final rise in questions, which could be interpreted as a high boundary tone, is found in all speakers even though it occurs more frequently in some speakers and less in other speakers. Although there appears to be a great deal of variation in the use of local F0 rises sentence-finally, this can be interpreted as an optional use of intonational high boundary tones, consistent with Brunelle, Ha and Grice (2012)'s results for Northern speakers.

Generally, the results of this study show a more robust difference between declaratives and interrogatives than those of Brunelle, Ha and Grice (2012). The variation in intonation between studies may depend on the data collecting techniques used. It seems to be that contrastive wordlists yield fairly strong intonation effects (this study and Nguyễn and Boulakia 1999), while contextualized frame sentences with distractors and randomization yield patterns that are much more variable (Brunelle, Ha and Grice 2012) and that natural data doesn't seem to yield clear patterns even if there is clear intonation marking here and there (Brunelle 2016). This suggests that all this is part of Vietnamese intonation grammar, but how it plays out varies depending on how aware of the need for disambiguation speakers are.

In conclusion, our study shows that the difference between declarative and the interrogative intonation in Southern Vietnamese can be accounted for by two mechanisms: an overall higher phrase F0 height for the interrogative, and higher strength values (i.e., larger F0 range and longer duration) of sentence final tones for the interrogative. These intonational strategies are salient not only in interrogatives without particles but also in contexts in which modal particles are present. Therefore, these findings confirmed the results of a great number of the precedent studies (see references), which stated that the tonal languages, like Chinese and Vietnamese, possessing a rich system of modal morphemes, are also characterized by a dimension 'intonation' which plays an important role on the syntactical-pragmatic level. Nevertheless, compared to Western languages, this is actually marginal. The results and data of this investigation contribute to the study of Vietnamese prosody, cross-language and cross-dialectal prosodic comparison.

Acknowledgements

We would like to thank the subjects for their voluntary participation in the experiment. We thank Marc Brunelle for providing the Praatscript. We also thank Prof. Mark Alves and the two anonymous reviewers for their constructive and insightful comments and suggestions.

Appendix 1: List of the sentences

Statements

1. Cô Hai đi mua rau răm.
   'Miss Hai went to buy herbal mint.'
2. Anh Tư đi mua hai cây lê
   'Tư went to buy two pear plants.'
3. Bà Hồng trồng vài hàng ngò
   'Mrs Hồng planted few rows of coriander'
4. Dì Hiền lì xì dì Hòa nhiều tiền
   'Aunt Hiền gave Aunt Hòa much money'
5. Chú Chín đến hái lá mía
   'Uncle Chín came picking sugarcane leaves'
6. Thím Tám muốn bán sáu thúng lúa
   'Aunt Tám wanted to sell six rice barrels'

7. Chị Dậu lượm một bị nặng
   'Sister Dậu found a heavy bag'
8. Cụ Mận nhận nặn một tượng bự
   'Old Mận accepted to make a big statue'
9. Hải Nhỏ gởi Thủy bảy tỉ
   'Hải Nhỏ sent Thủy seven billion'
10. Bảy Hiển bỏ mũ ở bãi biển
    'Seven Hiển left a hat on the beach'

Yes-No questions without particles

11. Cô Hai đi mua rau răm?
    'Did Miss Hai go to buy herbal mint?'
12. Anh Tư đi mua hai cây lê?
    'Did Tư go to buy two pear plants?'
13. Bà Hồng trồng vài hàng ngò?
    'Did Mrs Hồng plant few rows of coriander?'
14. Dì Hiền lì xì dì Hòa nhiều tiền?
    'Did Aunt Hiền give Aunt Hòa much money?'
15. Chú Chín đến hái lá mía?
    'Did Uncle Chín comes picking sugarcane leaves?'
16. Thím Tám muốn bán sáu thúng lúa?
    'Did Aunt Tám want to sell six rice barrels?'
17. Chị Dậu lượm một bị nặng?
    'Did Sister Dậu find a heavy bag?'
18. Cụ Mận nhận nặn một tượng bự?
    'Did Old Mận accept to make a big statue?'
19. Hải Nhỏ gởi Thủy bảy tỉ?
    Did Hải Nhỏ send Thủy seven billion?'
20. Bảy Hiển bỏ mũ ở bãi biển?
    Did Seven Hiển leave a hat on the beach?'

Questions with the particle *ư*

21. Cô Hai đi mua rau răm ư?
    'Did Miss Hai go to buy herbal mint?'
22. Anh Tư đi mua hai cây lê ư?
    'Did Tư go to buy two pear plants?'
23. Bà Hồng trồng vài hàng ngò ư?
    'Did Mrs Hồng plant few rows of coriander?'
24. Dì Hiền lì xì dì Hòa nhiều tiền ư?
    'Did Aunt Hiền give Aunt Hòa much money?'
25. Chú Chín đến hái lá mía ư?
    'Did Uncle Chín comes picking sugarcane leaves?'
26. Thím Tám muốn bán sáu thúng lúa ư?
    'Did Aunt Tám want to sell six rice barrels?'
27. Chị Dậu lượm một bị nặng ư?
    'Did Sister Dậu find a heavy bag?'
28. Cụ Mận nhận nặn một tượng bự ư?
    'Did Old Mận accept to make a big statue?'
29. Hải Nhỏ gởi Thủy bảy tỉ ư?
    Did Hải Nhỏ send Thủy seven billion?'
30. Bảy Hiển bỏ mũ ở bãi biển ư?
    Did Seven Hiển leave a hat on the beach?'

Questions with the particle *không*

31. Cô Hai có đi mua rau răm không?
    'Did Miss Hai go to buy herbal mint?'
32. Anh Tư có đi mua hai cây lê không?
    'Did Tư go to buy two pear plants?'
33. Bà Hồng có trồng vài hàng ngò không?
    'Did Mrs Hồng plant few rows of coriander?'
34. Dì Hiền có lì xì dì Hòa nhiều tiền không?
    'Did Aunt Hiền give Aunt Hòa much money?'
35. Chú Chín có đến hái lá mía không?
    'Did Uncle Chín comes picking sugarcane leaves?'
36. Thím Tám có muốn bán sáu thúng lúa không?
    'Did Aunt Tám want to sell six rice barrels?'
37. Chị Dậu có lượm một bị nặng không?
    'Did Sister Dậu find a heavy bag?'
38. Cụ Mận có nhận nặn một tượng bự không?
    'Did Old Mận accept to make a big statue?'
39. Hải Nhỏ có gởi Thủy bảy tỉ không?
    Did Hải Nhỏ send Thủy seven billion?'
40. Bảy Hiển có bỏ mũ ở bãi biển không?
    Did Seven Hiển leave a hat on the beach?'

Or questions with the particle *hay*

41. Cô Hai đi mua rau răm hay rau lang?
    Did Miss Hai go to buy herbal mint or sweet potato leavers?'
42. Anh Tư đi mua hai cây lê hay nho ?
    'Did Tư go to buy two pear plants or grape plants?'.
43. Bà Hồng trồng vài hàng ngò hay hành?
    'Did Mrs Hồng plant few rows of coriander or spring onion?'
44. Dì Hiền lì xì dì Hòa nhiều tiền hay vàng?
    'Did Aunt Hiền give Aunt Hòa much money or gold?'
45. Chú Chín đến hái lá mía hay lá lúa?
    'Did Uncle Chín come picking surgarcane leaves or rice leaves?'
46. Thím Tám muốn bán sáu thúng lúa hay sắn?
    'Did Aunt Tám want to sell six rice barrels or manioc barrels?'
47. Chị Dậu lượm một bị nặng hay nhẹ?
    'Did Sister Dậu find a heavy bag or light bag?'
48. Cụ Mận nhận nặn một tượng bự hay nhẹ?
    'Did Old Mận accept to make a big statue or a light statues'
49. Hải Nhỏ gởi bảy tỉ chổ Thủy hay Hiển ?
    'Did Hải Nhỏ send seven billion to Thủy or Hiển?'
50. Bảy Hải bỏ mũ ở bãi biển hay chổ nhỏ Hiển?
    'Did Seven Hiển leave a hat on the beach or at little Hiển's place?'

Wh-questions with the particle *ai*

51. Ai đi mua rau răm?
    'Who went to buy herbal mint?'
52. Ai đi mua hai cây lê?
    'Who went to buy two pear plants?'
53. Ai trồng vài hàng ngò?
    'Who planted a few rows of coriander?'

54. Ai lì xì dì Hòa nhiều tiền?
    'Who gave Aunt Hòa much money?'
55. Ai đến hái lá mía?
    'Who came picking sugarcane leaves?'
56. Ai muốn bán sáu thúng lúa?
    'Who wanted to sell six rice barrels?'
57. Ai lượm một bị nặng?
    'Who found a heavy bag?'
58. Ai nhận nặn một tượng bự?
    'Who accept to make a big statue?'
59. Ai gởi Thủy bảy tỉ?
    'Who sent seven billion to Thủy?'
60. Ai bỏ mũ ở bãi biển?
    'Who left a hat on the beach?'

Wh-questions with the particle *cho ai*

61. Cô Hai đi mua rau răm cho ai?
    ''For whom did Miss Hai go to buy herbal mint?'
62. Anh Tư đi mua hai cây lê cho ai?
    For whom did Tư go to buy two pear plants?'
63. Bà Hồng trồng vài hàng ngò cho ai?
    'For whom did Mrs Hồng plant few rows of coriander?'
64. Dì Hiền lì xì nhiều tiền cho ai?
    'For whom did Aunt Hiền give Aunt Hòa much money?'
65. Chú Chín đến hái lá mía cho ai?
    'For whom did Uncle Chín comes picking sugarcane leaves?'
66. Thím Tám muốn bán sáu thúng lúa cho ai?
    'For whom did Aunt Tám want to sell six rice barrels?'
67. Chị Dậu lượm một bị nặng cho ai?
    'For whom did Sister Dậu find a heavy bag?'
68. Cụ Mận nhận nặn một tượng bự cho ai?
    'For whom did Old Mận accept to make a big statue?'
69. Hải Nhỏ gởi bảy tỉ cho ai?
    'For whom did Hải Nhỏ send Thủy seven billion?'
70. Bảy Hiển bỏ mũ ở bãi biển cho ai?
    'For whom did Seven Hiển leave a hat on the beach?'

Wh-questions with the particle *chừng nào*

71. Chừng nào Cô Hai đi mua rau răm?
    'When will Miss Hai go to buy herbal mint?'
72. Chừng nào Anh Tư đi mua hai cây lê?
    'When will Tư go to buy two pear plants?'
73. Chừng nào Bà Hồng trồng vài hàng ngò?
    'When will Mrs Hồng plant few rows of coriander?'
74. Chừng nào Dì Hiền lì xì dì Hòa nhiều tiền?
    'When will Aunt Hiền give Aunt Hòa much money?'
75. Chừng nào Chú Chín đến hái lá mía?
    When will Uncle Chín comes picking sugarcane leaves?'
76. Chừng nào Thím Tám muốn bán sáu thúng lúa?
    'When will Aunt Tám want to sell six rice barrels?'
77. Chừng nào Chị Dậu lượm một bị nặng?
    'When will Sister Dậu find a heavy bag?'

78. Chừng nào Cụ Mận nhận nặn một tượng bự?
    'When will Old Mận accept to make a big statue?'
79. Chừng nào Hải Nhỏ gởi Thủy bảy tỉ?
    When will Hải Nhỏ send Thủy seven billion?'
80. Chừng nào Bảy Hiển bỏ mũ ở bãi biển?
    When will Seven Hiển leave a hat on the beach?'

Wh-questions with the particle *hồi nào*

81. Cô Hai đi mua rau răm hồi nào?
    'When did Miss Hai go to buy herbal mint?'
82. Anh Tư đi mua hai cây lê hồi nào?
    'When did Tư go to buy two pear plants?'
83. Bà Hồng trồng vài hàng ngò hồi nào?
    'When did Mrs Hồng plant few rows of coriander?'
84. Dì Hiền lì xì dì Hòa nhiều tiền hồi nào?
    'When did Aunt Hiền give Aunt Hòa much money?'
85. Chú Chín đến hái lá mía hồi nào?
    When did Uncle Chín comes picking sugarcane leaves?'
86. Thím Tám muốn bán sáu thúng lúa hồi nào?
    'When did Aunt Tám want to sell six rice barrels?'
87. Chị Dậu lượm một bị nặng hồi nào?
    'When did Sister Dậu find a heavy bag?'
88. Cụ Mận nhận nặn một tượng bự hồi nào?
    'When did Old Mận accept to make a big statue?'
89. Hải Nhỏ gởi Thủy bảy tỉ hồi nào?
    When did Hải Nhỏ send Thủy seven billion?'
90. Bảy Hiển bỏ mũ ở bãi biển hồi nào?
    When did Seven Hiển leave a hat on the beach?'

Appendix 2: Backgrounds of participants

	Participants code	**Place of birth of participants**	**Place of birth of participants' fathers**	**Place of birth of participants' mothers**
Teachers	F1	An Giang	An Giang	An Giang
	F2	Sài Gòn	Sài Gòn	Sài Gòn
	F3	Sài Gòn	Sài Gòn	Sài Gòn
	F4	Sài Gòn	Sài Gòn	Sài Gòn
	F5	Sài Gòn	Sài Gòn	Sài Gòn
	M1	Sài Gòn	Sài Gòn	Sài Gòn
	M2	Sài Gòn	Sài Gòn	Sài Gòn
	M3	Sài Gòn	Sài Gòn	Sài Gòn
	M4	Sài Gòn	Sài Gòn	Sài Gòn
	M5	Sài Gòn	Sài Gòn	Sài Gòn
Students	F6	Bến Tre	Bến Tre	Bến Tre
	F7	Sài Gòn	Sài Gòn	Sài Gòn
	F8	Sài Gòn	Sài Gòn	Sài Gòn
	F9	Sài Gòn	Sài Gòn	Sài Gòn
	F10	Sài Gòn	Sài Gòn	Sài Gòn
	F11	Long An	Long An	Long An
	M6	Tiền Giang	Tiền Giang	Tiền Giang
	M7	Sài Gòn	Sài Gòn	Sài Gòn
	M8	Bến Tre	Bến Tre	Bến Tre
	M9	Bến Tre	Bến Tre	Bến Tre

Appendix 3: Mixed effect model results

	Duration	F01	F02	F03	F04	F05
Contexts	F(8, 9442)=39, p<0.001	F(8, 4165)=39, p<0.001	F(8, 4980)=59, p<0.001	F(8,6046)=73, p<0.001	F(8,4638)=57, p<0.001	F(8,3037)=43, p<0.001
Tones	F(4, 5)=3.5, p0.099 ns.	F(4, 6)=46, p<0.001	F(4, 4874)=76, p<0.001	F(4, 6572)=62, p<0.001	F(4, 4510)=55, p<0.001	F(4, 5)=49, p<0.001
Speakers	F(25,12933)=66, p<0.0001	F(25,12524)=2198, p<0.0001	F(25,12754)=2360, p<0.0001	F(25,12783)=2382, p<0.0001	F(25,12467)=2504, p<0.0001	F(25,11224)=2106, p<0.0001
Contexts * tones	F(32, 12876)=7.6, p<0.001	F(32, 8591)=2.4, p<0.001	F(32, 9659)=2.5, p<0.001	F(32, 10826)=2.5, p<0.001	F(32, 9302)=3.4, p<0.001	F(32, 6888)=2.8, p<0.001
Speakers x tones	F(76,12933)=21.5, p<0.0001	F(76,12602)=40.5, p<0.0001	F(76,12797)=44.2, p<0.0001	F(76,12834)=57.3, p<0.0001	F(76,12730)=54.9, p<0.0001	F(76,12293)=45.4, p<0.0001
Contexts x speakers	F(200, 12933)=0.5, p=1, ns.	F(200, 12610)=3.9, p<0.0001	F(200, 12802)=5.0, p<0.0001	F(200, 12843=5.8, p<0.0001	F(200, 12768)=5.4, p<0.0001	F(200, 12570)=6.9, p<0.0001
Contexts x speakers x tones	F(608, 12933)= 0.3, p=1, ns.	F(608, 12610)= 1.2, p=0.045, ns.	F(608, 12802)= 0.95, p=0.051, ns.	F(608, 12843)= 0.91, p=0.06, ns.	F(608, 12768)= 0.87, p=0.08, ns.	F(608, 12570)= 0.11, p=0.053, ns.

	intensity 1	intensity 2	intensity 3	intensity 4	intensity 5
Contexts	F(8,5823)=26, p<0.001	F(8,7836)=36, p<0.001	F(8,7880)=74, p<0.001	F(8,8676)=52, p<0.001	F(8,9065)=84, p<0.001
Tones	F(4, 5)=3.9, p=0.078 ns.	F(4, 11)=3.6, p=0.038 ns.	F(4, 6)=3.2, p=0.089 ns.	F(4, 5)=0.5, p=0.69 ns.	F(4, 5)=0.8, p=0.54 ns.
Speakers	F(25,12755)=165.8, p<0.0001	F(25,12923)=294, p<0.0001	F(25,12923)=587, p<0.0001	F(25,12931)=269, p<0.0001	F(25,12932)=130, p<0.0001
Contexts * tones	F(32, 10451)=1.5, p=0.035 ns.	F(32, 12039)=1.5, p=0.026 ns.	F(32, 12138)=1.6, p=0.009	F(32, 12544)=1.3, p=0.1 ns.	F(32, 12712)=1.5, p=0.023 ns.
Speakers x tones	F(76,12904)=7.2, p<0.0001	F(76,12931)=4.0, p<0.0001	F(76,12932)=5.9, p<0.0001	F(76,12933)=5.6, p<0.0001	F(76,12933)=5.9, p<0.0001
Contexts x speakers	F(200, 12933)=2.8, p<0.0001	F(200, 12932)=3.7, p<0.0001	F(200, 12933)=6.9, p<0.0001	F(200, 12933)=4.4, p<0.0001	F(200, 12933)=2.1, p<0.0001
Contexts x speakers x tones	F(608, 12933)= 0.8, p=1, ns.	F(608, 12932)= 0.84, p=0.99, ns.	F(608, 12933)= 1.1, p=0.052, ns.	F(608, 12933)= 0.78, p=1, ns.	F(608, 12933)= 0.55, p=1, ns.

Appendix 4: Post-hoc pairwise comparison results.
INT: intensity. Question: question without particle.

Sentence types		Duration	F01	F02	F03	F04	F05	INT1	INT2	INT3	INT4	INT5
Ai	Cho ai	.036	.680	.263	.962	.229	.328	.280	.377	.549	.895	.007
	Chừng nào	.189	.104	.287	.133	.040	.016	.517	.031	.001	.551	.239
	Hồi nào	.038	.681	.281	.759	.342	.537	.995	.170	.010	.115	.000
	Không	.338	.245	.180	.650	.283	.544	.369	.930	.823	.370	.934
	Or	.706	.524	.363	.067	.050	.365	.157	.615	.736	.992	.003
	Question	.363	.993	.907	.500	.492	.943	.242	.940	.619	.594	.887
	Statement	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**
	Ư	.745	.783	.866	.346	.102	.431	.487	.590	.796	.881	.000
Cho ai	Ai	.036	.680	.263	.962	.229	.328	.280	.377	.549	.895	.007
	Chừng nào	.545	.013	.010	.064	.219	.063	.693	.000	.000	.364	.146
	Hồi nào	.959	.990	.972	.496	.673	.556	.047	.000	.000	.001	.000
	Không	.086	.254	.677	.519	.910	.632	.838	.134	.197	.205	.000
	Or	.000	.063	.000	.001	.170	.889	.540	.451	.062	.774	.627
	Question	.000	.464	.026	.230	.364	.132	.843	.119	.855	.417	.000
	Statement	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**
	Ư	.000	.229	.088	.086	.402	.770	.500	.519	.092	.574	.000
Chừng nào	Ai	.189	.104	.287	.133	.040	.016	.517	.031	.001	.551	.239
	Cho ai	.545	.013	.010	.064	.219	.063	.693	.000	.000	.364	.146
	Hồi nào	.526	.012	.010	.024	.136	.024	.411	.230	.211	.315	.000
	Không	.556	.001	.003	.166	.186	.024	.810	.007	.000	.069	.105
	Or	.032	.178	.742	.895	.690	.045	.434	.001	.000	.442	.080
	Question	.007	.045	.231	.255	.074	.004	.607	.005	.000	.176	.178
	Statement	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**
	Ư	.041	.089	.128	.406	.484	.041	.984	.001	.000	.552	.000
Hồi nào	Ai	.038	.681	.281	.759	.342	.537	.995	.170	.010	.115	.000
	Cho ai	.959	.990	.972	.496	.673	.556	.047	.000	.000	.001	.000
	Chừng nào	.526	.012	.010	.024	.136	.024	.411	.230	.211	.315	.000
	Không	.076	.255	.654	.232	.819	.996	.161	.043	.000	.000	.000
	Or	.000	.058	.000	.000	.067	.640	.008	.000	.000	.001	.000
	Question	.000	.442	.023	.052	.614	.341	.024	.003	.000	.000	.000
	Statement	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**
	Ư	.000	.209	.083	.013	.192	.762	.176	.000	.000	.003	.495
Không	Ai	.338	.245	.180	.650	.283	.544	.369	.930	.823	.370	.934
	Cho ai	.086	.254	.677	.519	.910	.632	.838	.134	.197	.205	.000
	Chừng nào	.556	.001	.003	.166	.186	.024	.810	.007	.000	.069	.105
	Hồi nào	.076	.255	.654	.232	.819	.996	.161	.043	.000	.000	.000
	Or	.025	.007	.001	.038	.220	.706	.481	.350	.872	.127	.000
	Question	.002	.082	.026	.754	.535	.442	.715	.794	.250	.527	.716
	Statement	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**
	Ư	.033	.033	.071	.466	.429	.812	.734	.322	.965	.085	.000
Or	Ai	.706	.524	.363	.067	.050	.365	.157	.615	.736	.992	.003
	Cho ai	.000	.063	.000	.001	.170	.889	.540	.451	.062	.774	.627
	Chừng nào	.032	.178	.742	.895	.690	.045	.434	.001	.000	.442	.080
	Hồi nào	.000	.058	.000	.000	.067	.640	.008	.000	.000	.001	.000
	Không	.025	.007	.001	.038	.220	.706	.481	.350	.872	.127	.000
	Question	.256	.264	.142	.027	.020	.157	.680	.396	.089	.260	.000
	Statement	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**
	Ư	.926	.528	.045	.093	.604	.872	.188	.924	.883	.772	.000

Question	Ai	.363	.993	.907	.500	.492	.943	.242	.940	.619	.594	.887
	Cho ai	.000	.464	.026	.230	.364	.132	.843	.119	.855	.417	.000
	Chừng nào	.007	.045	.231	.255	.074	.004	.607	.005	.000	.176	.178
	Hồi nào	.000	.442	.023	.052	.614	.341	.024	.003	.000	.000	.000
	Không	.002	.082	.026	.754	.535	.442	.715	.794	.250	.527	.716
	Or	.256	.264	.142	.027	.020	.157	.680	.396	.089	.260	.000
	Statement	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**
	Ư	.218	.628	.589	.592	.072	.213	.368	.344	.120	.155	.000
Statement	**Ai**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**
	Cho ai	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**
	Chừng nào	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**
	Hồi nào	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**
	Không	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**
	Or	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**
	Question	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**
	Ư	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**
Ư	Ai	.745	.783	.866	.346	.102	.431	.487	.590	.796	.881	.000
	Cho ai	.000	.229	.088	.086	.402	.770	.500	.519	.092	.574	.000
	Chừng nào	.041	.089	.128	.406	.484	.041	.984	.001	.000	.552	.000
	Hồi nào	.000	.209	.083	.013	.192	.762	.176	.000	.000	.003	.495
	Không	.033	.033	.071	.466	.429	.812	.734	.322	.965	.085	.000
	Or	.926	.528	.045	.093	.604	.872	.188	.924	.883	.772	.000
	Question	.218	.628	.589	.592	.072	.213	.368	.344	.120	.155	.000
	Statement	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**

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