REALIZATIONS OF THE TRITONAL PITCH ACCENT IN PARAGUAYAN GUARANI

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ABSTRACT

A recent model of intonational phonology of Paraguayan Guarani proposed that Paraguayan Guarani has a tritonal pitch accent, which is typologically rare. The tritonal pitch accent was claimed to be HLH* realized over two syllables, as a falling tone on the pretonic syllable and a rising tone on the tonic syllable. This paper investigates the phonetic realizations of the pitch accent by systematically varying the stress location, the word length, and the inter-stress interval. The overall results corroborated the previous findings, but the alignment of the first H of HLH* was found to vary between the pretonic and the propretonic syllables depending on the stress location and the speaker's age/sex. Additionally, the medial L tone was often realized right after the onset of the tonic syllable, and LH* was more common when stress is word-initial, suggesting H+LH* would be a proper tonal category of the pitch accent.

Keywords: Paraguayan Guarani, tritonal pitch accent, tonal alignment, intonational phonology

1. INTRODUCTION

Paraguayan Guarani (henceforth Guarani) is a Tupi-Guarani language, and together with Spanish, is an official language of Paraguay. Guarani is a highly agglutinative language, and the default word order is Subject-Verb-Object (SVO), though the location of arguments can vary depending on informational properties as well as discourse status and the transitivity of the verb ([1, 2, 3, 4]).

For word prosody, Guarani has lexical stress, typically located at the end of a lexical item. But when a word includes more than one morpheme that has stress, only the last stress is realized ([1, 4, 5, 6]). For example, stress on the verb *ho* 'go' remains the same when the unstressed prospective aspect/modal suffix /-ta/ is added as in [o-hó-ta], (3p-go-PROSP) '(S)he will go'. But, when the stressed, desiderative modal suffix /-sé/ is added to the verb, *ho*, stress shifts to the suffix as in [o-ho-sé] (3-go-DES) '(S)he wants to go'. Stress is not marked orthographically when it falls on the word-final vowel or on a nasalized vowel, which is marked with a tilde (*porã* [põr̃ã́] 'well'). Otherwise, stress is orthographically marked by an acute accent on the stressed vowel (e.g., *ñandu* 'spider' vs. *ñandúre* 'spider-at'; *porã* 'well' vs. *porãta* 'well-future'). Acoustically, stressed syllables are longer and stronger in intensity than unstressed syllables.

Several studies [5-10] have examined the intonation pattern of Guarani analyzed in the Autosegmental-metrical framework [11-13], either to investigate how focus is prosodically realized [5-7] or how prosodic constituents are related to morphosyntactic constituents [8-10]. Clopper and Tonhauser [5, 7] proposed that two-word (Subj + Verb) declaratives in Guarani have two tonal contours: a hat contour and a two-peak contour. The hat contour is formed by a rising pitch accent (L*+H), followed by a falling pitch accent (H+L*), and the two peak contour is formed by a sequence of two rising pitch accents. They also found a high plateau between the two pitch accents in each contour type, and explained the high plateau in the hat contour by interpolation between the two adjacent H tones (i.e., L*+H H+L*), but did not provide any explanation for the high plateau in the two-peak contour (i.e., L*+H L*+H). It was suggested that pitch accent categories in Guarani should be further explored. Burdin and collaborators [6] examined focus prosody of a noun phrase (Noun + Adjective) in Guarani and confirmed the two contour types proposed in [5, 7], but claimed that the tone-syllable alignment in the pitch accents was not contrastive, revising the rising pitch accent to "LH" and the falling pitch accent to "HL", i.e., without marking the L tone with a star (*).

Jun and Zubizarreta [8-10] examined intonation of complex sentences in Guarani, which varied in morpho-syntactic structures as well as the length of the words and sentences. They claimed that Guarani has only one pitch accent, a tritonal HLH*, and an Accentual Phrase (AP) whose edges are marked by a H boundary tone. An AP in Guarani typically includes one word, and like other AP languages (e.g., Japanese, Korean, Bengali, Georgian; see [14, 15]), it can include more than one word when the words are short and closely related syntactically and semantically. They further found that, unlike other AP languages, the AP in Guarani also marks a syntactic constituent, i.e., a complex predicate, which includes a Verb and a Low-modifier [8-10, 16, 17], regardless of the number of words in the predicate.

When an AP includes more than one word, the pitch accent is realized on the last stressed syllable of the AP. Since an AP begins and ends with a H tone, the tonal pattern of an AP is /H HLH* Ha/ ('Ha' is an AP-final H boundary tone; 'a' refers to an AP; the AP-initial H is also a boundary tone, so it could be labeled as 'aH'). Jun & Zubizarreta [9] claimed that the HLH* pitch accent is realized as a falling tone on the pretonic syllable and a rising tone (LH) on the tonic syllable. But when the AP is the last AP of an Intonational Phrase (IP) ending with a L% in declaratives, the pitch accent is often realized as a falling tone on the pretonic syllable and a low tone on the tonic syllable. This would correspond to the H+L* pitch accent proposed in [5, 6, 7]. In Jun and Zubizarreta's model, the falling pitch accent is analyzed as an allotone of HLH*, i.e., HLH* can be realized as HLL* when it is immediately followed by a L%. By analyzing the pitch accent being HLH* and APs having H boundary tones, a high plateau between two pitch accents observed in [5, 6, 7] was explained by the interpolation between the H tone at the edge of the tritonal pitch accent and the H boundary tone of an AP, and also between the H boundary tone of adjacent APs.

Thus, these two existing models differ whether a pitch accent is a simple rising tone (LH) or a falling-rising tone (HLH) when the pitch accent is not IP-final. Because the falling-rising pitch accent is realized over two syllables, i.e., falling tone on the pretonic syllable and a rising tone on the tonic syllable, while the rising pitch accent proposed in [5, 6, 7] is realized on the tonic syllable, the main difference between these two models is whether there is a falling tone on the pretonic syllable or not.

The goal of the current paper is to investigate how a pitch accent is realized in Guarani, examining the f0 contours on the pretonic syllables as well as the tonic syllable when the pitch accent is not IP-final.

2. PRESENT STUDY

2.1. Methods and Procedures

The participants included one male (M1 in his late 30s) and three females (F1 in her mid 30s, F2 in her early 50s, F3 in her early 60s). M1 and F1 are from Coronel Oviedo, F2 is from Concepción, and F3 is from Asunción, Paraguay. All speakers are bilingual in Guarani and Spanish. M1 and F1 spoke primarily Guarani growing up and learned Spanish later but continue to use Guarani on a daily basis. The data from M1 and F1 were collected in Paraguay using a digital recorder, and the data from F2 and F3 were collected over *Zoom.*

Each speaker produced 84 declarative sentences varying in word orders and syntactic structures, designed to examine the tone-syllable alignment of the pitch accent. The target words varied in the location of stress and the number of unstressed syllables. The list of sentences was written in Guarani orthography and presented to the speakers in a randomized order in two repeated sets using Microsoft PowerPoint, thus collecting 8 tokens per utterance across all speakers.

To investigate the tone-syllable alignment of the pitch accent contour, two sub-datasets (33 sentences) were examined, where the target word is sentence-medial. The target word had two types of stress location, final or penultimate, and differed in the number of unstressed syllables (s), from zero to four, before the stressed syllable (S), i.e., S, sS, ssS, sssS, ssssS in the final stress condition and Ss, sSs, ssSs, sssSs, ssssSs in the penultimate stress condition.

All the recorded sentences were segmented and annotated in *Praat*. For all the target words, the vocalic intervals were annotated whether a vowel is stressed ('V') or unstressed ('v'). The location of unstressed vowel relative to the stressed vowel was labeled as "v#' (i.e., v1, v2, v3, and v4), with '#' indicating how far away an unstressed vowel is from the stressed vowel in terms of syllable count: '1' being the closest to 'V' and '4' being the furthest. The onset consonant of the stressed syllable, if present, was also annotated with the label 'C'.

For all the annotated intervals, pitch and temporal measurements were obtained automatically using a Praat script. Mean f0 (Hz) values and the time points for the maximum and the minimum f0 of the target vowels were collected. Pitch track errors (e.g., pitch halving and doubling) were manually corrected whenever possible. Pitch track errors that could not be resolved (e.g., missing pitch value) were excluded from further analysis. All f0 values in Hz were then converted to semitone using the formula: F0 (semitone) = $12*(\log_2 (f_1/f_2))$, where f_2 is the mean f0 value in Hz for each speaker. The time point marking the onset of a tonic syllable was also collected. The entire dataset was then imported into R software [18] for statistical analyses and data visualization.

3. RESULTS

Our data confirmed the findings of [9] that Guarani has a tritonal pitch accent, a falling tone immediately followed by a rising tone, with the f0 peak on the stressed syllable. Figure 1 shows an example of the HLH* tritonal pitch accent, with H* realized toward the end of the stressed syllable (word-final for the first two words) and the first H realized at the beginning of the pretonic syllable. The middle L tone is between

the pretonic syllable and the tonic syllable. The word/AP-initial syllable(s) show a high plateau until the first H tone of the tritonal pitch accent, and this high tone can be similar to that of the preceding H* (as in the second word/AP in Figure 1), or can be slightly lower than that of the preceding H* (as in the final word/AP in Figure 1), or can be reset to be higher than that of the preceding H* (as in the second word/AP in Figure 2). Figure 2 shows that H* of the tritonal pitch accent can be downstepped (!H*) when the word is sentence-medial or final. (In the final position, it can also be L* before L%, as in Figure 1). Figure 2 also shows that the f0 on the post-tonic syllable *ra* is higher than the preceding !H* tone. This post-tonic high tone is AP-final Ha, proposed in [9].

Figure 3 shows the mean f0 values (in semitone) for each vowel of the sentence-medial target word (except for initially stressed words) up to the stressed syllable for each speaker when stress is final (top) and penultimate (bottom). Thus, these plots are a rough estimation of f0 contours of the target word. This figure shows that the mean f0 values are similar across v2, v3, and v4, reflecting the high plateau between the beginning of the word and the propretonic syllable (v2). (In the penultimate stress plots (bottom), the mean f0 of the word-initial vowels is higher than that of the following vowel due to the onset consonant in the target word, i.e., microprosody.) It also shows that the mean f0 of the stressed syllable (V) is higher than that of v1 when stress is final than when it is penultimate, which is expected because the star-tone of the sentence-medial pitch accent is often !H*. Also, the mean f0 of v1 can be similar to or slightly higher than that of V when the f0 difference in the falling tone on v1 is small and V carries !H* as shown in Figure 2 (*gua kué*). But for younger female speakers (F1 and F2), the mean f0 on the stressed vowel was substantially lower than that of v1 for some sentences when stress is penultimate (e.g., those in the sSs and ssSs conditions). This is because they sometimes produced L* or L+>H* similar to Spanish prenuclear pitch accent. The influence of Spanish on their Guarani is shown more clearly in the following section where the tone-syllable alignment of the first H of HLH* is shown.

3.1. Alignment of the first H of HLH*

[9] claimed that the tritonal pitch accent starts with a falling tone on the pretonic syllable followed by a rising tone on the tonic syllable. To find out whether the H of the falling (HL) starts on the pretonic syllable (v1) or the propretonic syllable (v2), the mean f0 values of v2 were compared with the maxf0 and min-f0 of v1. If v1 carries a HL tone, a max f0 would occur at v1 onset and a min f0 at v1 offset. If the H of HL

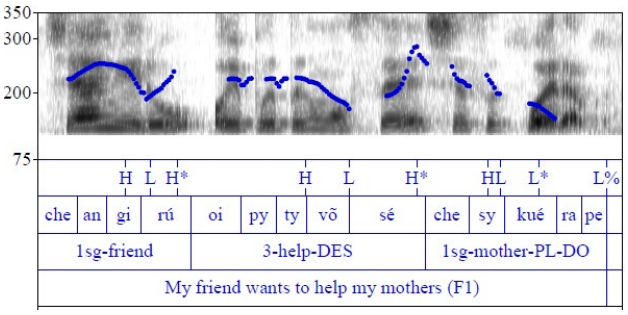

Figure 1: The tonic syllable carries a high tone (H*) when not sentence-final. The pretonic syll begins with H. The L is between the pretonic and the tonic syllable.

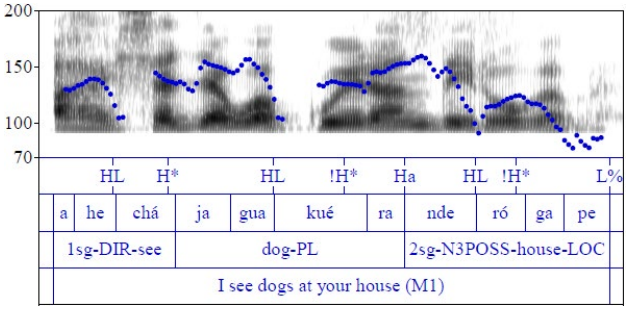

Figure 2: The tritonal pitch accent can be HL!H* in sentence-medial or -final. Ha is higher than !H*

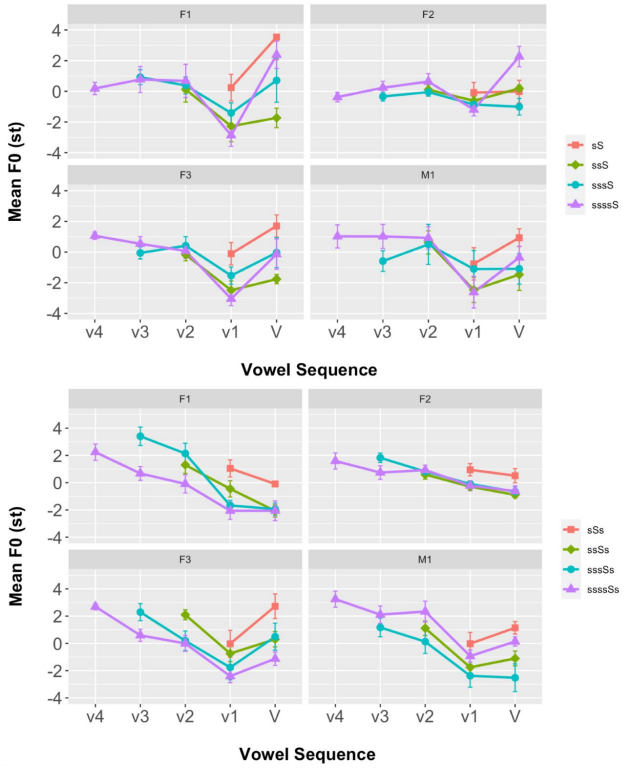

Figure 3: Mean f0 values (in semitone) of each unstressed vowel up to the stressed vowel (V) when stress is final (top) and penultimate (bottom) for each speaker.

starts from v2, v1's maxf0 would be significantly lower than v2 mean, or roughly in the middle of v2 mean and v1's minf0. But if the falling tone starts at

the beginning of v1, as claimed in [9], v2's mean f0 would be similar to or slightly higher than v1's maxf0 (reflecting f0 declination between v2 and v1). Figure 4 shows f0 values (in semitone) on v2_mean, v1_max and v1_min for each speaker when stress is final (top) and penultimate (bottom).

As shown in Figure 4, the alignment of the first H varied across speakers and the stress location. In the final stress condition, v1_max is not significantly different from v2_mean for the speakers F3 and M1, suggesting the falling starts on the pretonic syllable. However, for F1 and F2 (the younger female speakers), the v1_max was significantly lower than v2_mean, suggesting that the falling starts earlier than the pretonic syllable. In the penult stress condition, v1_max was significantly lower than v2_mean for all speakers, but especially so for F1, the youngest female. She sometimes did not produce the first H of the tritonal pitch accent, reducing it to a bitonal pitch accent L+H* or L+>H*, similar to Spanish.

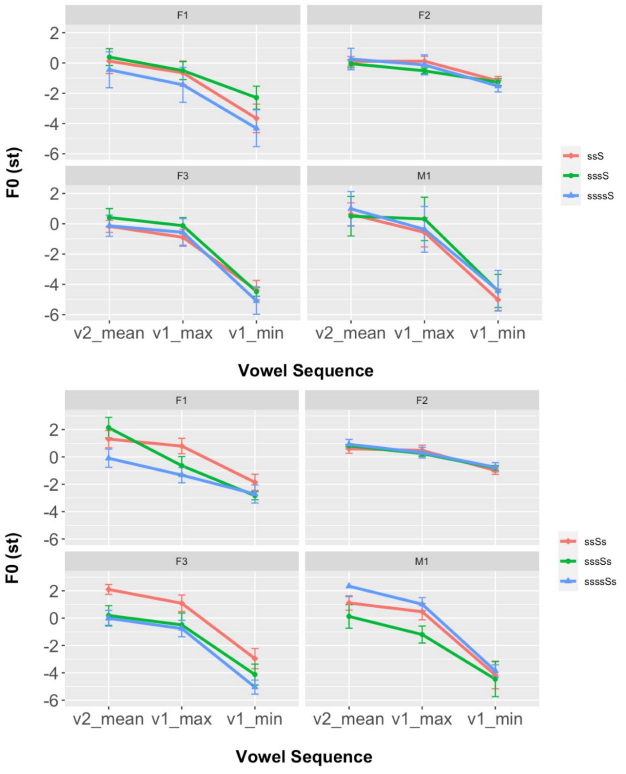

Figure 4: F0 (in semitone) for the v2 mean, the maxf0 of v1, and the minf0 of v1 for each speaker when stress is final (top) and penultimate (bottom).

3.2. Alignment of the medial L of HLH*

The tone-syllable alignment of the medial L tone varied between the pretonic and tonic syllable as claimed in previous studies [5-10], but this variation seemed to be influenced by the intervening consonant between the pretonic and tonic syllables. When the intervening consonant was a sonorant, L was often aligned right after the onset of the tonic syllable. See Figure 5 (those tokens where the stressed syllable had L* are not included). Furthermore, when stress is word-initial, a rising f0 was often observed, reaching its peak at the end of the syllable, suggesting that the medial L tone is a unit with the following H* (LH*), instead of the preceding H (HL). Therefore, a proper tonal category of the tritonal pitch accent would be H+LH*.

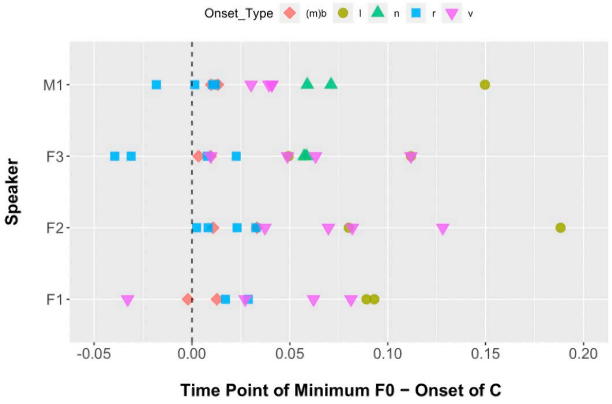

Figure 5: The alignment of the L tone relative to the onset C of the tonic syllable (the vertical dotted line).

4. DISCUSSION AND CONCLUSION

The current data confirmed [9] that Guarani has a tritonal pitch accent, and further demonstrated that the alignment of the first H is variable across speakers and stress location. When stress is word-final, the first H started at the onset of the pretonic syllable, only for the male and the oldest female speakers (M1 and F3), but when stress is penultimate, all speakers tended to start the H at the propretonic syllable. Furthermore, the younger female speakers sometimes produced no initial H and produced a bitonal pitch accent L+H* or L+>H* (delayed f0 peak on the posttonic syllable), which is similar to the prenuclear pitch accent in Spanish. Because all speakers participated in the current study are Spanish-Guarani bilinguals and the elicitation was conducted in Spanish, the influence of Spanish intonation to Guarani intonation might be expected, but given that young female speakers showed more variable alignment of the initial H and more Spanish-like pitch accent, sound change might be currently in progress in Guarani intonation. It is also possible that a H+LH* tritonal pitch accent might be in the process of being simplified to LH* because the HLH tritonal pitch accent is very rare cross-linguistically; So far, the most common tritonal pitch accent type is LHL, found in several varieties of Spanish [19-23], Italian [24], Serbo-Croatian [25, 26], and Brazilian Portuguese [27]. Data from more speakers should be examined to confirm the current findings and suggested interpretations.

5. REFERENCES

[1] Gregores, E., Suárez, J. A. 1967. *A Description of Colloquial Guaraní.* Mouton, The Hague.

[2] Velázquez-Castillo, M. 1995. Noun incorporation and object placement in discourse: The case of Guaraní, In: Downing, P., Noonan, M. (eds), *Word Order in Discourse*, Amsterdam and Philadelphia: John Benjamins, 555–79.

[3] Estigarribia, B. 2020. *A Grammar of Paraguayan Guarani*. UCL press.

[4] Tonhauser, J., Colijn, E. 2010. Word order in Paraguayan Guarani, *International Journal of American Linguistics*. 76(2), 255-288.

[5] Clopper, C. G., Tonhauser, J. 2013. The prosody of focus in Paraguayan Guaraní, *International Journal of Amercian Linguistics*, 79, 219-251.

[6] Burdin, R., Phillips-Bourass, S., Turnbull, R., Yasavul, M., Clopper, C., Tonhauser, J. 2015. Variation in the prosody of focus in head- and head/edge-prominence languages", *Lingua* 165, 254-276.

[7] Clopper, C. G., Tonhauser, J. 2011. On the prosodic coding of focus in Paraguayan Guarani, *Proceedings of the Twenty-eighth West Coast Conference on Formal Linguistics*, 249-257.

[8] Zubizarreta, M.L., Jun, S.-A. 2021. Morpho-syntactic and prosodic cues in Complex Predicates. A Case Study. A talk presented (virtually) at the Workshop 6: Complex predicates across languages: Variation and acquisition, Societas Linguistica Europaea, Athens, Greek.

[9] Jun, S.-A., Zubizarreta, M.L. 2022. Paraguayan Guarani: Tritonal pitch accent and Accentual Phrase. *Proceedings of INTERSPEECH 2022*, Incheon, Korea, 5303-5307.

[10] Zubizarreta, M.L. 2022. The verbal phrase in Paraguayan Guarani: A case study on the role of prosody in linearization, *Languages* 7, 221.

[11] Pierrehumbert, J. 1980. *The Phonology and Phonetics of English intonation*. PhD dissertation. MIT.

[12] Beckman, M., Pierrehumbert, J. 1986. Intonational structure in Japanese and English, *Phonology Yearbook* 3, 15-70.

[13] Ladd, R. D. 1996/2008. *Intonational Phonology*. Cambridge University Press.

[14] Jun, S.-A. (ed.), 2005. *Prosodic Typology: The Phonology of Intonation and Phrasing*. Oxford University Press.

[15] Jun, S.-A. (ed.), 2014. *Prosodic Typology II: The Phonology of Intonation and Phrasing*. Oxford University Press.

[16] Zubizarreta, M.L, Pancheva, P. 2017a. A Formal characterization of Person-based alignment: The case of Paraguayan Guarani, *Natural Language and Linguistic Theory* 35, 1161–1204.

[17] Zubizarreta, M.L., Pancheva, P. 2017b. A note on the syntax of possession in Paraguayan Guarani. In: Fernández-Soriano, O., Castroviejo, E., Pérez-Jiménez, I. (eds), *Boundaries, Phases, and Interfaces*, John Benjamins, 85–104.

[18] R Core Team. 2021. R: A language and environment for statistical computing. Vienna, Austria. Available at http://www.R.project.org/

[19] Prieto, P., D'Imperio, M., Gili Fivela, B. 2005. Pitch accent alignment in Romance: primary secondary associations with metrical structure, *Language and Speech* 48(4), 359-396.

[20] Gabriel, C., Feldhausen, I., Pešková, A., Colantoni, L., Lee, S.-A., Arana, V., Labastía, L. 2010. Argentinian Spanish intonation. In: Prieto, P., Roseano, P. (eds) *Transcription of intonation of the Spanish languages,* 285-317.

[21] Gabriel, C., Feldhausen, I., Pesková, A., Colantoni, L., Lee, S-A., Arana, V., Labastía, L. 2010. Argentinian Spanish intonation. In: Prieto, P., Roseano, P. (eds), *Transcription of Intonation of the Spanish Language*. Lincom Europa, 285-317.

[22] García, M. 2011. *The intonational patterns of the Peruvian Amazonian Spanish (PAS)*, MA Thesis. University of Stony Brook.

[23] Froemming, B., Rao, R. 2021. The tritonal pitch accent in the broad focus declaratives of the Spanish spoken in Cuenca, Ecuador: An acoustic and sociolinguistic analysis, *Estudios de Fonética Experimental (Journal or Experimental Phonetics*), 119-140.

[24] Gili Fivela, B. 2004. *The phonetics and phonology of intonation: The case of Pisa Italian*. Ph.D. Dissertation, Scuola Normale Superiore, Pisa.

[25] Smiljanic, R. 2004. *Lexical, pragmatic, and positional effects on prosody in two dialects of Croatian and Serbian: An Acoustic Study*. London: Routledge.

[26] Yu, K. M. 2008. *The prosody of second position clitics and focus in Zagreb Croatian*, UCLA, M.A. Thesis.

[27] Ferreira, L. 2008. *High initial tones and plateaux in Spanish and Portuguese neutral declaratives: Consequences to the relevance of F0, duration and vowel quality as stress correlates.* PhD Dissertation. University of Illinois at Urbana-Champaign.