



Learning L2 Rhythm: does the direction of acquisition matter?

Lieke van Maastricht¹, Emiel Krahmer¹, Marc Swerts¹ & Pilar Prieto^{2,3}

¹ Tilburg Center for Communication and Cognition, Tilburg University, The Netherlands

² ICREA, Institutió Catalana de Recerca i Estudis Avançats, Catalunya

³ Universitat Pompeu Fabra, Barcelona, Spain

l.j.vanmaastricht@uvt.nl, e.j.krahmer@uvt.nl, m.g.j.swerts@uvt.nl, pilar.prieto@upf.edu

Abstract

This study investigates the acquisition of second language (L2) rhythm by speakers of Dutch and Spanish, two languages that traditionally are considered to be rhythmically different. Specifically, it investigates whether the direction in which the L2 is learned (from Dutch to Spanish, or vice versa) influences the ease of acquisition. Dutch has relatively complex syllable structure and uses extensive final and accentual lengthening, while Spanish has a less complex syllable structure and uses less accentual and final lengthening. Consequently, Dutch and Spanish lie at opposite ends of the rhythm continuum. Eckman's ([1], [2]) Markedness Differential Hypothesis (MDH) predicts that Dutch rhythm is more marked, and therefore more difficult to acquire for SLD, than Spanish rhythm is for DLS. When comparing accentual and final lengthening data by L2 learners with a low (A2) and high (B2) proficiency level in both learning directions, it is therefore expected that the DLS will advance more towards their respective target native speaker control group than SLD. Our results, however contradict the MDH, as they show that SLD outperform the DLS for both measures.

Index Terms: second language rhythm, accentual lengthening, final lengthening, Spanish, Dutch

1. Introduction

Germanic languages such as Dutch and Romance languages such as Spanish have traditionally been classified as prototypically 'stress-timed' and 'syllable-timed', respectively ([3], [4]). This distinction stems from the perception that in syllable-timed languages syllables would generally have a comparable duration, while in stress-timed languages it would be the duration between stressed syllables that appears similar. Even though acoustic studies show that both syllable length and the duration between stressed syllables vary in both language families, there does appear to be a continuum in the discrimination of languages based on their rhythm ([5]). Additionally, Dutch and Spanish are distinguishable from one another based solely on prosodic features by native listeners as young as five days old, as well as adults ([6], [7]). Several typological differences between Spanish and Dutch have been hypothesized to underlie this perceptual distinction: e.g., the fact that Spanish prefers an open syllable structure with few possibilities for more complex structures, while Dutch is classically documented as more varied in its syllable structure with more complex and closed syllable structures as the norm ([8], [9]). Moreover, Spanish employs less of final lengthening and vowel reduction ([10]) than Dutch, in which both forms of lengthening are employed extensively ([11]-[16]).

Due to the complex interplay of the aforementioned factors in the production of speech rhythm, it is not surprising that prior studies have shown that second language (L2) learners have difficulties acquiring speech rhythm adequately. Consequently, they generally transfer the rhythmic properties of their native language (L1) to the L2 (e.g., [17]-[19]). These transfer effects occur both between languages that are typologically different, as well as within language classes ([20]), and prosodic transfer has been shown to occur from the L1 to the L2, but also vice versa ([21]). Another factor that may be of relevance in L2 rhythm acquisition, which to our knowledge has never been investigated, is whether acquiring the rhythmic properties of a 'stress-timed' L2 is more difficult for speakers of a 'syllable-timed' L1, than vice versa. While several studies examined the transfer of rhythmic properties from a syllable-timed and a stress-timed L1 to a different stress- or syllable-timed L2, an analysis in which the same two languages are compared cross-directionally would help to determine which factors contribute to the ease of acquisition of specific L2 properties, as well as shed more light on the processes underlying L2 acquisition in general.

Therefore, the current study compares speech of Dutch learners of Spanish (DLS) and Spanish learners of Dutch (SLD) with varying proficiency levels, to determine whether the learning direction affects two language specific properties that are known to correlate with speech rhythm: accentual and final lengthening. We base our predictions on Eckman's ([1], [2]) Markedness Differential Hypothesis (MDH), which states that the areas of the target language that differ from the L1 and are more marked than the L1 will be difficult for L2 learners. A phenomenon is more typologically marked if its presence in a language implies the presence of another phenomenon; but the presence of the latter does not imply the presence of the former ([1], p. 320-321). As explained above, Dutch and Spanish differ considerably when it comes to speech rhythm, both in the metrics that evaluate rhythm production and the final and accentual lengthening measures that underlie these metrics, and in the way the rhythm of both languages is perceived by L1 listeners. As for the markedness aspect, young children initially produce speech with a rhythm that can have been classified as more 'even timed', or syllable-timed, and only later acquire the rhythmic properties of their L1 ([24] - [29]). As we know of no cases where infants first produced a stress-timed rhythm (to adapt to more syllable-timed speech rhythm if this is typical of their L1 in a later stage), we assume that what is classically known as a stress-timed rhythm is more typologically marked than a traditional syllable-timed rhythm. Therefore, we predict that it is more difficult for Spanish L1 speakers to acquire the speech rhythm and its correlates of Dutch than vice versa.

Recently, the MDH has been used in two studies related to the acquisition of L2 prosody, one of them being the only study known to us to investigate prosodic transfer effects in both learning directions: Rasier and Hiligsmann examine transfer effects in the production of (de)accentuation patterns to signal focus in speech by Dutch learners of French and French learners of Dutch. Based on the MDH, they predict that languages that use both structural and pragmatic constraints for focus marking, such as Dutch, are more marked than languages that only employ structural rules, such as French. Their results confirm the MDH, as they found that Dutch L2 learners acquire the accentuation patterns of French more successfully than the French learners of Dutch ([30]). Ordin and Polyanskaya ([31]) compare speech data from more and less proficient German and French learners of English. They, like us, conclude that a stress-timed rhythm is more marked than a syllable-timed one, and see the MDH confirmed in their results, which show that although both learner groups advance towards the L1 target, proficient French learners of English did not produce the durational variability typical of the target language, while proficient German learners of English did. However, Li and Post ([17]), report that both advanced learner groups produce L1 target values, independent of their L1 being stress-timed or syllable-timed in their study on the acquisition of speech rhythm by more and less proficient German and Chinese learners of English, which contradicts the findings by [31].

This study therefore tests the hypothesis that Dutch rhythm is more marked and thus more difficult to acquire by SLD, than vice versa. DLS, SLD and Spanish and Dutch L1 speakers, read aloud a controlled set of sentences, which enables a direct comparison of accentual and final lengthening measures of data by learners of both learning directions, as well as an L1 baseline.

2. Method

2.1. Participants

Thirty adults participated in the experiment: 5 L1 speakers of Dutch and 5 L1 speakers of Spanish, as well as 10 DLS and 10 SLD of two proficiency levels. All participants were raised as monolinguals and participated voluntarily. The DLS were students of the Spanish program at the University of Groningen or of Fuentes Academia de Español. The SLD were students at the Escuela Oficial de Idiomas in Madrid or Barcelona. The L2 learners were subdivided into a beginner and an advanced group. The aforementioned institutions use the proficiency levels of the Common European Framework of Reference for Languages ([32]), which facilitated the process of determining the proficiency level of our participants, which corresponded to the level of the last course they had successfully completed: A2 for the less proficient groups (indicated by a '-' behind the learner group abbreviation, e.g., DLS-), and B2 for the more proficient groups (indicated by a '+' behind the learner group abbreviation, e.g., DLS+). Controlling for knowledge of other Romance languages proved impossible in the Dutch group, as French is obligatory at most levels in the Dutch secondary educational system. Conversely, controlling for knowledge of other West-Germanic languages in the L1 Spanish data is difficult as English is taught at Spanish high schools, as is German occasionally. Data by participants that reported knowledge of any other L2 that might make them more capable to produce the target rhythm were excluded from analysis. Although other metalinguistic factors could not be controlled

for, the majority of the participants had at least completed some form of secondary education as they were students, either at a university or a language school. None of them reported being a professional musician.

2.2. Materials

For each language, participants read aloud 20 sentences¹: 5 sentences with mostly open syllable structure (CV), 5 sentences with mostly closed syllable structure (CVC), and 10 sentences that reflected typical syllable structures used in either Dutch or Spanish (Mixed). Both the Spanish CV and CVC sentences were taken from [10]. The Dutch CV and CVC sentences were created by the authors to match the Spanish sentences. The mixed sentences were taken or adapted from [6] and [10]. All sentences were matched as best as possible for number of syllables, orthographic words, and intonational phrases. Infrequent words or complex sentence constructions were avoided where possible to facilitate the task for L2 learners. Example (1) shows a target utterance from Dutch (Du) and Spanish (Sp), for each of the categories, with the number of syllables per sentence in parentheses.

(1) CV syllable structure (16 syllables):

Du: De mama van Susana is een gezellige lerares

Sp: La madre de Susana es una buena profesora

CVC syllable structure (15 syllables):

Du: De wedstrijd van de voetbalclub was niet in het sportcomplex

Sp: El mitin del club de tenis no fue en el parking del club

Mixed syllable structure (16 syllables):

Du: De dader werd helaas bij gebrek aan bewijs vrijgesproken

Sp: Reportan inundaciones graves en la primavera

2.3. Procedure

Experimental sessions were performed individually and took roughly 20 minutes. The recordings, made with Praat ([33]) and the internal microphone of an Apple Macbook Pro, occurred in a quiet room. Participants were instructed to read the sentences at a normal pace from the screen of the laptop, and to repeat the sentence if there were hesitations or other irregularities in their speech. They filled in a questionnaire to ensure that they met the requirements of each language group concerning L1/L2, proficiency, age and gender.

2.4. Prosodic analysis

For the Dutch sentences both segmental annotation and syllabification was performed manually by the first author in Praat by visual inspection of speech waveforms and wideband spectrograms following standard criteria (see [34], [20], [10]). The Spanish sentences were automatically segmented into phonemes and syllables using Easyalign ([35]), and then checked manually by the first author. Additionally, each syllable was marked for its phrasal position as either non-final, intermediate phrase final or intonational phrase final. Following Prieto et al. (2012), the criterion for an IP break was a pause of at least 200 ms. A break of less than 200 ms and a continuation rise characterized an ip boundary. Prosodic prominence was also annotated, distinguishing between three levels: unstressed, stressed unaccented, and nuclear accented. Figure 1 illustrates the analysis of the Dutch utterance *De mama van Nadine komt uit Malaga* ('Nadine's mother is from Malaga'), produced by a Dutch L1 speaker. The first tier contains the orthographic

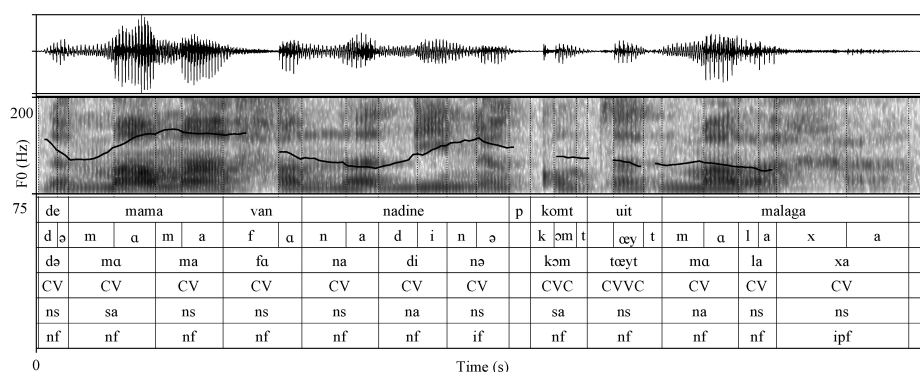


Figure 1: Waveform, spectrogram, f0 contour, and labeling scheme used for the Dutch utterance *De mama van Nadine komt uit Malaga* 'Nadine's mother is from Malaga', produced by a L1 speaker of Dutch.

transcription, the second and third ones the phonetic and syllabic segmentation, and in the fourth tier syllable structure is annotated. In the two final tiers prominence and phrasal position is coded.

2.5. Statistical analysis

Following Prieto et al. (2012), we carried out two General Linear Mixed Model analyses to test the effects of prominence level and phrasal position on syllable timing patterns, using IBM SPSS Statistics 22 ([36]). In both cases, the response variable was syllable duration in ms. The fixed factors were Language Group (L1 Dutch, L1 Spanish, DLS+, DLS-, SLD+, SLD-) and Prominence Level (unstressed, stressed accented, nuclear accented) in the first case, and Language group and Phrasal Position (non-final, ip final, IP final) in the other. Subject and test items were set as random factors.

3. Results

First, the results of L1 speakers of Dutch and Spanish are presented to form a baseline regarding the effect of prominence and phrasal position on syllable duration, to which the L2 results are compared at a later stage. Discussion of the results is included in each subsection.

3.1. Native speaker baseline

Regarding the effect of phrasal prominence on timing patterns by Dutch and Spanish L1 speakers, we hypothesized that prominence level would be reflected in syllable duration, and that it would do so more strongly in L1 Dutch than in L1 Spanish. Indeed, the analysis revealed a significant main effect of Language Group ($F(5, 9372) = 34.33$ $p < .001$) and Prominence Level ($F(2, 9372) = 888.69$ $p < .001$) on syllable duration, as well as a significant interaction ($F(10, 9372) = 15.35$; $p < .001$). Pairwise comparisons (always performed with the Bonferroni method) between the L1s show that they differ significantly from each other (at $p < .001$). Furthermore, the different prominence levels are all significantly different from each other within both L1 groups (at $p < .001$). As expected, syllables are lengthened more as their phrasal prominence increases in both languages, but more so in Dutch than in Spanish.

Concerning the effect of phrasal position on timing patterns by L1 speakers of Spanish and Dutch, we predicted that phrasal position would likewise be reflected in syllable duration, and that it would do so more in L1 Dutch than in L1 Spanish. As expected, the analysis shows a significant main effect of Language Group ($F(5, 9372) = 27.30$; $p < .001$) and

Phrasal Position ($F(2, 9372) = 809.83$; $p < .001$) on syllable duration, and a significant interaction ($F(10, 9372) = 9.92$; $p < .001$). Pairwise comparisons reveal that the two languages differ in their durational patterns (at $p = .03$). Within the Dutch L1 group all different phrasal positions differ from each other (at $p < .001$), with the exception of the difference between ip final and IP final syllables (at $p = .354$). In the Spanish L1 data, all phrasal positions differ significantly from each other as well, but while the difference between ip final and IP final syllables is only just significant (at $p = .043$), the significance of the difference between all the other groups is substantially larger (at $p < .001$). As expected, non-final syllables are lengthened less than ip and IP final ones in both languages, and final lengthening is stronger in Dutch than in Spanish. These results are summarized in the outer left (L1 Dutch) and outer right (Spanish) columns of Figure 2, which shows the mean syllable durations (in ms) for both accentual (above) and final (below) lengthening.

3.2. First and second language comparisons

Next, the data of the DLS and SLD of both proficiency levels are compared with the L1 data, to determine whether any transfer effects occur from the L1 to the L2. Additionally, the data of L2 learner groups are compared with each other to ascertain whether the direction of acquisition influences the ease of acquisition, and if so, whether it does so in the hypothesized way. It was expected that DLS would advance more towards the L1 target than the SLD, Dutch having a more marked rhythm than Spanish. Figure 2 summarizes the results. The analysis reveals a significant main effect of Language Group ($F(5, 9372) = 34.33$; $p < .001$) as well as Prominence Level ($F(2, 9372) = 888.69$; $p < .001$) on syllable duration and a significant interaction ($F(10, 9372) = 15.35$; $p < .001$). Pairwise comparisons show that all language groups differ from each other in their durational patterns (at least at $p < .05$), with the exception of the DLS+ and DLS-, which do not differ significantly from the L1 Dutch (at $p = .632$, and $p = .057$, respectively). Within the 6 language groups the different prominence levels are all significantly different from each other syllables, and the longest duration for ip final syllables. From the two SLD groups, only the more proficient group succeeds in producing a distribution that is similar to the L1 Dutch one, in which non-final syllables are shortest and IP final syllables (at $p < .001$). As expected, all L2 groups show some degree of accentual lengthening. Unexpectedly, the SLD produce the longest syllable durations in all prominence conditions. They succeed in increasing the durational difference between

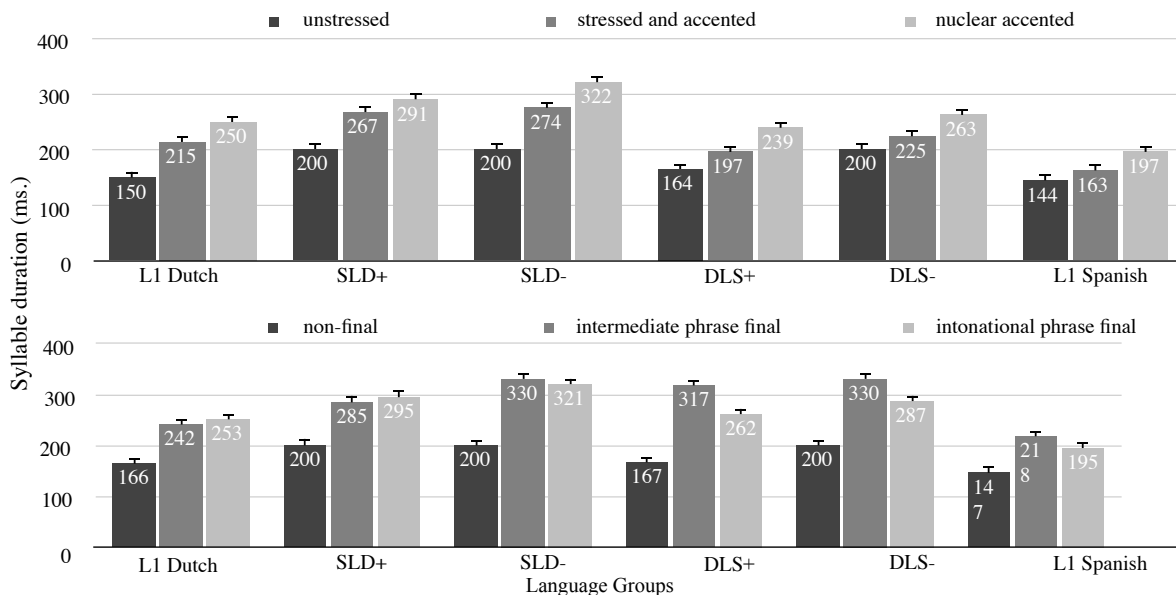


Figure 2: Mean syllable duration (in ms) in all Language Groups, by accentual (above) and final (below) lengthening conditions. The bars represent the standard error of the mean.

unstressed, and stressed and accented, as well as nuclear accented syllables, to a point that their values exceed the L1 Dutch ones. Conversely, the DLS produce syllable durations that are similar to those of the L1 Dutch in all prominence conditions, implying that aspects of their L1 are transferred to their L2. While the two SLD groups do differ significantly from the L1 Spanish, they also differ significantly from the L1 Dutch.

Turning to the effect of phrasal position on timing patterns by all speaker groups, the analysis revealed a significant main effect of Language Group ($F(5, 9372) = 27.30$; $p < .001$) and Phrasal Position ($F(2, 9372) = 809.08$; $p < .001$) on syllable duration as well as a significant interaction ($F(10, 9372) = 9.92$; $p < .001$). Pairwise comparisons revealed that both DLS groups differ significantly from the L1 Spanish group, but only the DLS- group also differs significantly from the L1 Dutch (all at $p < .05$). Both SLD groups differ significantly from both the L1 Dutch and the L1 Spanish. Furthermore, while the DLS+ do not differ significantly from the DLS- ($p = .156$), there is a significant difference between the SLD+ and the SLD- (at $p < .05$). Within Language Group comparisons show that both the SLD+ and SLD- mirror the pattern of the L1 Dutch: within both groups the different phrasal positions are all significantly different from one another (at $p < .001$), with the exception of the difference between ip final and IP final syllable (at $p = .339$ and $p = .331$, respectively). Similarly, the DLS+ and DLS- groups are comparable to the L1 Spanish, as all phrasal positions differ significantly from one another within both language groups (at $p < .001$ for both). Although both DLS groups produce syllables of a longer duration than the L1 Spanish in all phrasal positions, the pattern across positions is the same with the shortest duration for non-final syllables, followed by IP final are the longest, with ip final syllables occupying an intermediate position. The SLD- group produces a distribution that is similar to the L1 Spanish pattern.

4. Conclusion & Discussion

In conclusion, our results do not corroborate the MDH: Regarding both final and accentual lengthening, the SLD

approach their respective L1 target more than the DLS. While both L2 groups produce a syllable duration distribution that is similar, albeit higher, than the L1 target in the final lengthening analysis, there is a significant difference between both SLD groups, while there is no significant difference between the two DLS groups, suggesting that the improvement towards the target of the former is greater than the latter. Concerning accentual lengthening, the SLD also perform better than the DLS, as the latter do not differ significantly from the L1 Dutch, while the former do differ significantly from the L1 Spanish. The fact that mean syllable durations are higher overall might be a universal characteristic of L2 speech, resulting from its slower speech rate. Moreover, all learner groups show the same tendency in that the less proficient groups overshoot the L1 target substantially, and the more proficient groups approach target values. This implies that substantial final and accentual lengthening might be a characteristic of beginner/intermediate L2 speech in general, independent of the L1. Additional analyses with a larger proficiency level range (in preparation) will provide a more complete overview of the acquisition process, as neither of the more proficient L2 groups have reached target production for either accentual or final lengthening. Moreover, our data might benefit from analysis using rhythm metrics to determine how the correlates that are investigated in the present paper relate to measures of speech rhythm for the L1, but especially the L2 groups, as some of them control for speech rate.

5. Acknowledgements

The authors would like to thank Gerdientje Oggel, Johanna Sattler, Arthur Verbiest and Astrid van Winden for their help in organizing data collection. This research was supported by two grants to the first author: one of the Prins Bernhard Cultuurfonds (40005750/HEV/ILE) and another one of the Jo Kolk Studiefonds.

¹ The data presented in the current paper are part of a larger data-set, which contains 10 more sentences with mixed syllable structure, read by more speakers per proficiency group, leading up to a C2 level.

6. References

- [1] F. Eckman, "Markedness and the Contrastive Analysis Hypothesis," *Language Learning*, vol. 27, no. 2, pp. 315–330, 1977.
- [2] F. Eckman, "Typological markedness and second language phonology," *Phonology and second language acquisition*, vol. 36, pp. 95–115, 2008.
- [3] D. Abercrombie, *Elements of general phonetics*, Edinburgh: Edinburgh University Press, 1967.
- [4] K. Pike, *The intonation of American English*, Ann Arbor: University of Michigan, 1945.
- [5] F. Ramus, M. Nespor and J. Mehler, "Correlates of linguistic rhythm in the speech signal", *Cognition*, vol. 73, pp. 265–292, 1999.
- [6] T. Nazzi, J. Bertoncini, and J. Mehler, "Language discrimination by newborns: toward an understanding of the role of rhythm", *Journal of Experimental Psychology: Human perception and performance*, vol. 24, no. 3, pp. 756–766, 1998.
- [7] F. Ramus, E. Dupoux and J. Mehler, "The psychological reality of rhythm classes: Perceptual studies", in M. Solé, D. Recasens, & J. Romero (Eds.), *15th International Congress of Phonetic Sciences, 3-9 August, Barcelona, Spain, Proceedings*, 2003, pp. 337–342.
- [8] R. Dauer, "Stress-timing and syllable-timing reanalysed", *Journal of Phonetics*, vol. 11, pp. 51–62, 1983.
- [9] R. Dauer, "Phonetic and phonological components of language rhythm". Paper presented at the 11th International Congress of Phonetic Sciences, Tallinn, Estonia, 1987.
- [10] P. Prieto, M. Vanrell, L. Astruc, E. Payne and B. Post, "Phonotactic and phrasal properties of speech rhythm: Evidence from Catalan, English, and Spanish", *Speech Communication*, vol. 54, pp. 681–702, 2012.
- [11] T. Cambier-Langeveld, "The interaction between final lengthening and accentual lengthening: Dutch versus English", *Linguistics in the Netherlands*, vol. 16, no. 1, pp. 13–25, 1999.
- [12] T. Cambier-Langeveld, M. Nespor and V. van Heuven, "The domain of final lengthening in production and perception in Dutch", *Proceedings of EUROPEECH*, 1997.
- [13] T. Cambier-Langeveld and A. Turk, "A cross-linguistic study of accentual lengthening: Dutch vs. English", *Journal of Phonetics*, vol. 27, no. 3, pp. 255–280, 1999.
- [14] R. Dasher and D. Bolinger, "On pre-accentual lengthening", *Journal of the International Phonetic Association*, vol. 12, pp. 58–71, 1982.
- [15] P. Delattre, "A comparison of syllable length conditioning among languages", *International Review of Applied Linguistics in Language Teaching*, vol. 4, pp. 183–198, 1966.
- [16] P. Roach, "On the distinction between "stress-timed" and "syllable-timed" languages", in D. Crystal (Ed.), *Linguistic controversies*, London: Edward Arnold, 1982, pp. 73–79.
- [17] P. Carter, "Quantifying rhythmic differences between Spanish, English, and Hispanic English", in R. Gess and E. Rubin (Eds.), *Current Issues in Linguistic Theory*, Amsterdam: John Benjamins, vol. 272, pp. 63–75, 2005. A. Li and B. Post, "L2 acquisition of prosodic properties of speech rhythm, *Studies in Second Language Acquisition*, vol. 36, no. 02, pp. 223–255, 2014.
- [18] U. Gut, "Non-native speech rhythm in German", in M. Solé, D. Recasens, & J. Romero (Eds.), *15th International Congress of Phonetic Sciences, 3-9 August, Barcelona, Spain, Proceedings*, 2003, pp. 2437–2440.
- [19] A. Li and B. Post, "L2 acquisition of prosodic properties of speech rhythm, *Studies in Second Language Acquisition*, vol. 36, no. 02, pp. 223–255, 2014.
- [20] L. White and S. Mattys, "Calibrating rhythm: First language and second language studies", *Journal of Phonetics*, vol. 35, pp. 501–522, 2007.
- [21] L. van Maastricht, E. Krahmer and M. Swerts, "Prominence patterns in a second language: Intonational transfer from Dutch to Spanish and vice versa", Published online in *Language Learning*, DOI: 10.1111/lang.12141, 2015.
- [22] K. de Bot and D. Larsen-Freeman, "Researching second language development from a Dynamic Systems Theory perspective", in M. Verspoor, K. de Bot, and W. Lowie (Eds.), *A dynamic approach to second language development*, Amsterdam: Benjamins, pp. 5–24, 2011.
- [23] K. de Bot, W. Lowie and M. Verspoor, "A Dynamic Systems Theory approach to second language acquisition", *Bilingualism: Language and Cognition*, vol. 10, pp. 7–21, 2007.
- [24] E. Grabe, I. Watson and B. Post, "The acquisition of rhythmic patterns in English and French", in J. Ohala, Y. Hasegawa, M. Ohala, D. Granville, and A. Bailey (Eds.), *14th International Congress of Phonetic Sciences, 1-7 August, San Francisco, Proceedings*, 1999, pp. 1201–1204.
- [25] G. Allen and S. Hawkins. "Phonological rhythm: definition and development", in G. Yeni-Komshian, J. Kavanagh, & C. Ferguson (Eds.), *Child phonology: Vol. 1. Production*, New York: Academic Press, 1980, pp. 227–256.
- [26] N. Whitworth, "Speech rhythm production in three German-English bilingual families", *Leeds Working Papers in Linguistics & Phonetics*, vol. 9, pp. 175–205, 2002.
- [27] F. Bunta and D. Ingram, "The acquisition of speech rhythm by bilingual Spanish- and English-speaking four- and five-year-old children", *Journal of Speech, Language, and Hearing Research*, vol. 50, pp. 999–1014, 2007.
- [28] E. Payne, B. Post, P. Prieto, M. Vanrell and L. Astruc, "Measuring child rhythm", *Language and Speech*, vol. 55, pp. 203–229, 2012.
- [29] E. Schmidt and B. Post, "Language interaction in the development of speech rhythm in simultaneous bilinguals", in E. Delais-Roussarie, M. Avanzi and S. Herment (Eds.), *Prosody and Language in Contact*, Berlin: Springer, pp. 271–291, 2015.
- [30] L. Rasier and P. Hiligsmann, "Exploring the L1-L2 relationship in the L2 acquisition of prosody", *Online proceedings of first and second languages: Exploring the relationship in pedagogy-related contexts*, Oxford, United Kingdom. Retrieved from: <http://www.education.ox.ac.uk/wordpress/wp-content/uploads/2010/08/RasierHiligsmann.doc>, 2010.
- [31] M. Ordin and L. Polyanskaya, "Acquisition of speech rhythm in a second language by learners with rhythmically different native languages", *The Journal of the Acoustical Society of America*, vol. 138, no. 2, pp. 533–544, 2015.
- [32] Council of Europe, *Common European Framework of Reference for Languages: Learning, teaching, assessment*, Cambridge: Cambridge University Press, 2001.
- [33] P. Boersma and D. Weenink, *Praat: Doing phonetics by computer* (Version 6.0.04), Computer software, 2015. Retrieved from <http://www.fon.hum.uva.nl/praat/>
- [34] G. Peterson and I. Lehiste, "Duration of syllable nuclei in English", *Journal of the Acoustical Society of America*, vol. 32, pp. 693–703, 1960.
- [35] J. Goldman, "Easyalign: an automatic phonetic alignment tool under praat", in *Proceedings of Interspeech – Florence, Italy*, 2011, pp. 3233–3236.
- [36] IBM Corporation, *IBM SPSS Statistics* (version 22.0.0). Computer Software, 2015. Retrieved from <http://www.spss.com/software/statistics/>