

The Duration of the Consonants in Syllable-Final and Syllable-Initial Positions in Castilian Spanish

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ABSTRACT

In the current study we analyzed productions by native speakers of Castilian Spanish in order to investigate whether the syllable-final nasal has a different duration than (a) other consonants in syllable-final position and (b) a nasal in syllable-initial position. The results indicate that stress affects the duration of a syllable but does not affect the duration of a consonant, and that the duration of [m] and [n] in syllable-final position tends to be longer than that in syllable-initial position; furthermore, the duration of [l] in syllable-final position also tends to be longer than that in syllable-initial position. From these results we deduce that the duration of consonants, especially nasal and lateral, is affected by syllable position.

1. INTRODUCTION

The syllable-final nasal in Japanese, called a moraic nasal, is not able to compose a syllable alone, but functions as a unit of rhythm. However, the duration of the syllable-final nasal is theoretically equivalent to that of the other morae that correspond to syllables. Spanish, too, has a syllable-final nasal that behaves as a moraic nasal with respect to its articulation, that is, the syllable-final nasal assimilates with the following consonant completely, and the syllable position is similar to that in Japanese. On the other hand, the syllable-final nasal in Spanish does not function as a unit of rhythm like the moraic nasal in Japanese does.

However, in a previous experiment we observed that the ratio between the CV and N in CVN syllables is 1 : 0.47 on average in Japanese and 1 : 0.57 in Spanish [1]. That is, the durational proportion of the syllable occupied by the syllable-final nasal is slightly larger in Spanish than in Japanese. Furthermore, [n], [l] and [r] in stressed syllable-final position showed an increase of 28 % to 53 % in the duration in Castilian Spanish [2].

Based on these results, in the current study we analyzed Spanish words, read by speakers of Castilian Spanish, to investigate whether, the syllable-final nasal is different with respect to duration, from other consonants in syllable-final position, whether it is realized differently from a nasal that occurs in syllable-initial position, and whether the stress affects the duration of each consonant.

2. METHODS

The subjects are seven native speakers of Castilian Spanish [S1-S7]. All subjects are teachers of Spanish, who live in Tokyo.

The test words are composed of two or three syllables and include [l], [ʎ], [m], [n], [ɲ], [r] or [r] in syllable-initial position, or [l], [m], [n], or [r] in syllable-final position, as a target consonant. Furthermore, the syllables which include the target consonant are divided into two cases, stressed syllable and unstressed syllable, to investigate the effect of stress. Table 1 shows a list of the test words used in this study; the syllable which includes a target consonant is italicized, and the stressed syllable is indicated by boldface.

syllable-initial position	[l]	má la ga, Ma la ca, la vado
	[ʎ]	ceb o lla, tall a do, llama d a
	[m]	cá ma r a, ca ma d a, ma l eta
	[n]	no v e n a, no n ato, na v a ja
	[ɲ]	Es pa ña, ma ña na, so ña do r, so ña r a
	[r]	ma d era, ma r aca, ma r a b ú
	[r]	Na v arra, S erra no, r ate r o
syllable-final position	[l]	* and ó bal , bá lsamo, bal do s a
	[m]	tó tem, té mpano, tem pe r o
	[n]	** pa lasan, sá ndalo, San di no
	[r]	azú car, macha car , cho car , car nero

Table 1: List of the test words in this experiment

(*“andóbal” means “anyone who is not named”, and comes from a gypsy dialect. **“palasan” means “cane”, and comes from Tagalog. These words have very low frequencies in natural speech.)

Each subject was given a set of 35 test words which were embedded in the carrier sentence, *Esta palabra “ ” con*

frecuencia se pronuncia mal. (It means that this word “ ” is often pronounced unskillfully.) They were placed in random order. Subjects were instructed to read at a natural pace without pause to avoid prepausal lengthening effects in the target syllables located in word final position. The seven subjects were requested to repeat each sentence twice, producing 490 tokens in total.

The recorded test words were analyzed using the SUGI SPEECH ANALYZER. In this study the duration of each target consonant was measured with the help of spectrograms. The criterion for segmentation by Toledo [3] was applied to analyze the target consonants.

3. RESULTS

The [m] in the CV[m] which appeared after the stressed syllable and the [n] in the CV[n] which appeared after the stressed syllable were realized as another allophone by some subjects, so that they were excluded in this study.

Figure 1 shows the average duration of syllables containing target consonants, and Figure 2 shows the average duration of the target consonant. As Figure 1 shows, the value of the average duration of the stressed syllable by S1-S7 is 213 msec., and that of the unstressed syllable is 182 msec. That is, the average duration of the stressed syllable which includes the target consonant tends to be longer than that of the unstressed syllable. Then the comparison of the duration of the stressed syllable and that of the unstressed syllable was carried out with a t-test. The result indicates that the difference between the stressed syllable and the unstressed syllable is significant.

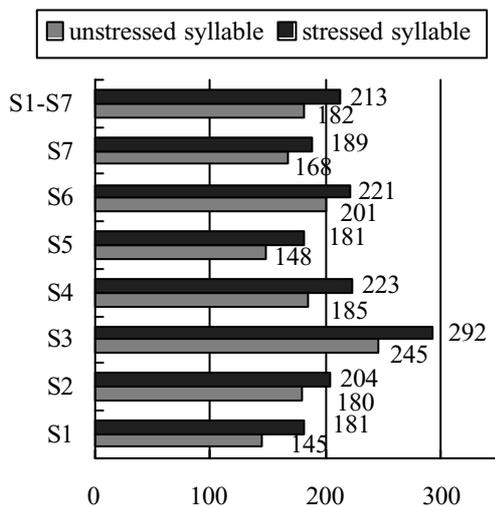


Figure 1: Average duration of the syllable which includes the target consonant (msec).

On the other hand, Figure 2 shows that the average duration of the target consonant within the stressed syllable is slightly longer than that within the unstressed syllable, except the case of S2. Then the comparison of the duration

of target consonant within the stressed syllable and that within the unstressed syllable was carried out with a t-test. The result indicates that there is no difference between the target consonant within the stressed syllable and that within the unstressed syllable statistically, except the case of S5.

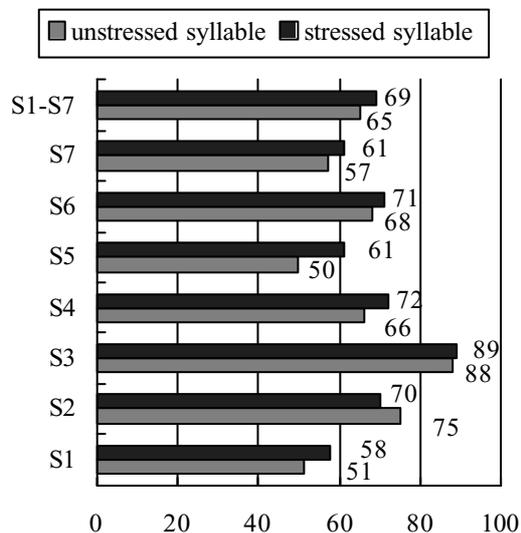


Figure 2: Average duration of the target consonant (msec).

Furthermore, Figure 3 shows the average duration of each target consonant by S1-S7. As Figure 3 shows, the target consonants, [m], [ɫ], [n], and [r], within the stressed syllable are a little longer than those within the unstressed syllable, though the difference is not significant statistically.

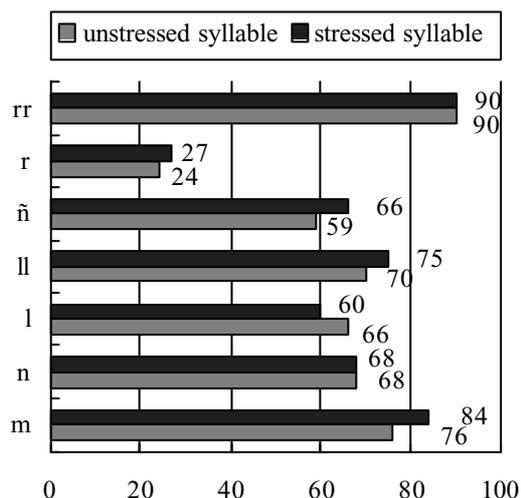


Figure 3: Average duration of each target consonant by S1-S7 (msec).

The above mentioned shows that the stress affects the duration of the syllable rather than that of the consonant.

Now we will compare the [l], [m], and [n] in the

syllable-initial position with those in the syllable-final position. In this comparison, the [ʌ] and [ɪ] were excluded, because they do not appear in syllable-final position in the phonetic environment of the used words. The [r] was also excluded, because it was realized as another allophone in syllable-final position by some subjects.

Figure 4, 5, and 6 show the average duration of the [l], [m], and [n] in syllable-initial position and those in syllable-final position respectively.

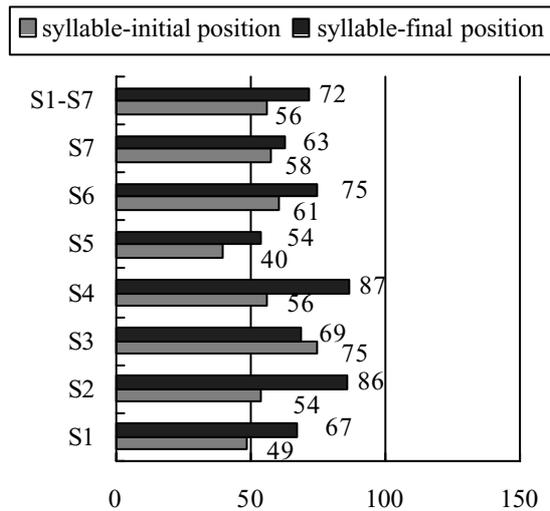


Figure 4: Average duration of the [l] in the syllable-initial position and that in the syllable-final position (msec).

As Figure 4 shows, the average duration of the [l] in syllable-initial position is shorter than that in syllable-final position, except the case of S3. Figure 5 and Figure 6 also indicate that the average duration of the [m] and the average duration [n] in syllable-initial position are shorter than those in syllable-final position. However, the difference between the average duration of the [l] in the syllable-initial position and that in the syllable-final position tends to be smaller than that of [m] or that of [n]. Then we compare the average duration of the [l] in syllable-initial position with that in syllable-final position through t-tests. The results of the t-tests indicate that only cases S2 and S4 show a significant difference between the average duration of the [l] in syllable-initial position and that in syllable-final position. On the other hand, the comparison of the average duration of the [m] in syllable-initial position and that in syllable-final position through t-tests indicates the significant difference except the case of S3. Furthermore, the difference between the average duration of the [n] in syllable-initial position and that in syllable-final position is also significant statistically except the cases of S3 and S5.

These results suggest that the duration of the [m] and [n] in

syllable-final position tends to be longer than that in syllable-initial position. The duration of [l] in syllable-final position also may be longer than that in syllable-initial position.

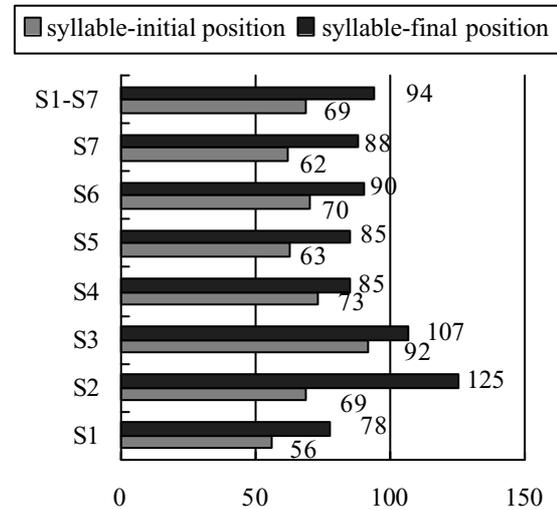


Figure 5: Average duration of the [m] in the syllable-initial position and that in the syllable-final position (msec).

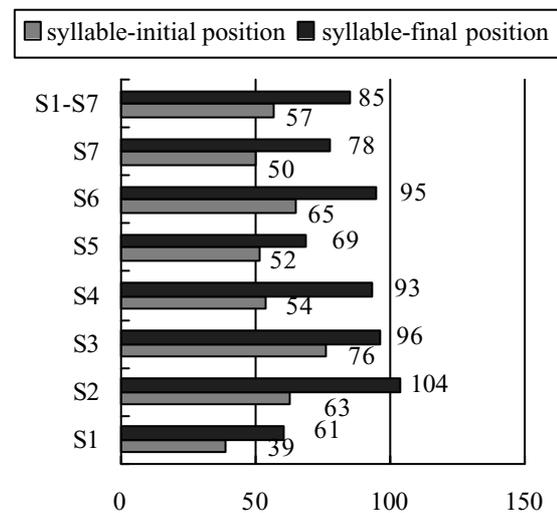


Figure 6: Average duration of the [n] in the syllable-initial position and that in the syllable-final position (msec).

In addition to the above comparison, Table 2 shows the raw data from the average duration of the target consonant + vowel by S1-S7, and Table 3 shows the raw data from the average duration of the consonant + vowel + target consonant by S1-S7. If we suppose that the duration of consonants is equivalent to that of vowels, the ratio between the target consonant and the vowel in the CV sequences containing the target consonant should be 1 : 1 theoretically, and the ratio between CV and the target

consonant in the CVC sequences containing the target consonant should be 1 : 0.5 theoretically. However, as Table 2 shows, all values of the target consonant in the CV sequences containing the target consonant are less than 1. On the other hand, the raw data in Table 3 show that the value of target consonant in the CVC sequences containing the target consonant is about 0.5 in all cases. That is, these results also suggest that the duration of the target consonant in syllable-final position tends to be longer than that in syllable-initial position.

[m] (msec)	V(msec)	ratio ([m] : V)
69	83	0.84 : 1
[n] (msec)	V(msec)	ratio ([n] : V)
57	101	0.57 : 1
[l] (msec)	V (msec)	ratio ([l] : V)
57	83	0.68 : 1
[ʎ] (msec)	V (msec)	ratio ([ʎ] : V)
72	117	0.61 : 1
[ɲ] (msec)	V(msec)	ratio ([ɲ] : V)
61	122	0.50 : 1
[r] (msec)	V(msec)	ratio ([r] : V)
25	107	0.23 : 1
[r̄] (msec)	V(msec)	ratio ([r̄] : V)
89	111	0.81 : 1

Table 2: Average duration of the target C and that of V in the CV sequences containing the target C by S1-S7.

CV(msec)	[m] (msec)	ratio (CV : [m])
177	94	1 : 0.53
CV(msec)	[n] (msec)	ratio (CV : [n])
184	85	1 : 0.46
CV(msec)	[l] (msec)	ratio (CV : [l])
142	72	1 : 0.51

Table 3: Average duration of CV and that of target consonant in the CV + target consonant syllables by S1-S7.

4. CONCLUSIONS

The results from the current study indicate the following three points:

- 1) stress affects the duration of a syllable rather than the duration of a consonant
- 2) the duration of [m] and [n] in syllable-final position tends to be longer than that in syllable-initial position
- 3) the duration of [l] in syllable-final position may be longer than that in syllable-initial position.

From 1) we deduce that the stress affects the duration of a vowel rather than that of a consonant, especially the lateral, nasal and vibrant consonants that were used in this study. However, the duration of a consonant within the stressed syllable tends to be a little longer than that within the unstressed syllable, though the difference between the durations is not significant statistically. This result accords with [2], though in this study the small increment of the duration in [l] and [n] is not seen, which is a little different from the result of [2]. Instead of [l] and [n], [m], [ʎ] and [ɲ] show a small increment of the duration in the current study. The cause of this difference may be due to the speech style in corpus. Furthermore, the results of 2) and 3) show that the duration of nasals, [m] and [n], and that of laterals, [l], are affected by syllable position. From this result, we also deduce that syllable position affects consonant duration. However, we have to treat other consonants which are included in some types of possible syllable from the viewpoint of phonotactics in order to confirm that the duration of a consonant depends on syllable position. Especially, we have to compare the duration of [θ] and [s] in syllable-initial position with that in syllable-final position, which have not been included in this study.

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REFERENCES

- [1] M. Takasawa, "Comparing the Syllable-Final Nasal in Japanese and Spanish", *Sophia Linguistica*, **49**, pp.145-160, 2002.
- [2] L. Del Barrio Estévez and S. Torner Castells, "La Duración consonántica en castellano", *LEA*, *XXI/1*, pp.99-126, 1999.
- [3] G. A. Toledo, *El ritmo en español. Estudio fonético con base computacional*, Madrid, Gredos, 1988.