The duration of filled pauses and prolongations in northern and southern dialects of Spanish1*

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ABSTRACT
This research focuses on the prosodic patterns of hesitations contrasted in Northern and Southern dialects of European Spanish, more precisely, on their duration. A corpus of 200 spontaneous utterances has been compiled (including 100 utterances from the northern dialects and 100 utterances from the southern ones, produced by 16 male and 16 female informants, respectively). The analysis has been carried out following the standardization protocol offered by Cantero (2019), in which the representative values of duration (in seconds) are taken for each syllable, and then these values undergo a process of standardization, in order to be comparable objectively and speaker-independently. Due to difficulties in establishing exact syllable boundaries in Spanish, it is not the relative duration of the syllables, but rather the relative duration of the distances between intensity peaks which is compared. It is expected that certain “neutral” hesitations –lengthenings and filled pauses with no specific communicative function – show durational differences in the examined dialects, as Southern dialects are considered to be of higher speech rate due to frequent segment elision than northern ones. This would imply that the relative duration of the examined hesitation phenomena with respect to its context– supposedly of the same absolute duration as in the northern dialects – is longer in the southern dialects. According to the results, nevertheless, Southern dialects present shorter absolute duration also in case of hesitation phenomena, and thus relative duration of hesitation phenomena with respect to their context coincide in the two examined Spanish variants.

KEYWORDS
hesitation, filled pauses, lengthenings, duration, standardization

1. Introduction

Hesitation is considered a disfluency phenomenon. There are several possible categorizations related to these phenomena (Neuberger 2014: 23), including, for instance, noises, repetitions, false starts, silent pauses, repairs,

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truncations, filled pauses and prolongations (Eklund, 2004; Gósy, 2002; Lickley, 1994, 2015; Rodríguez et al., 2001; Shriberg, 1994), the last two phenomena being the two most common subtypes of hesitation (Deme & Markó, 2013).

Prolongations form part of phenomena that are applied to gain time without implying necessarily the interruption of elocution. Their aim is to slow down the velocity of speech without affecting communication (Rebollo Couto, 1997: 667). Filled pauses lack specific meaning and are employed to provide the speaker with time in order to plan and to reorganize his/her speech (Stepanova, 2007, cited by Machuca & Ríos, 2016). Filled pauses and lengthening can be considered two different acoustic disfluency phenomena (Rodríguez et al., 2001, 2015), but the present study is based on authors holding that prolongations are subsumed under filled pauses (Maclay & Osgood, 1959, cited by Machuca, 2018), as a special, “lexical” type (Blondet, 2001, Villa et al., 2017), and the two phenomena will be treated together, focusing on the durational aspect of prolongations and filled pauses in two well-defined dialects of European Spanish.

Spanish is spoken by more than 400 million speakers all over the world, and due to this fact, it presents a considerable dialectal variation. There are two main dialectal areas in Europe sharing several common characteristics in their pronunciation: those from the north (including also central varieties) and the dialects from the south (including the varieties spoken in the Canary Islands, cf. Hualde, 2014: 285-288). The objective of this study is to compare the strategies of hesitation (with no specific communicative functions other than turn-holding) applied by the dialects of Spanish from both the north and the south, from the point of view of the duration of prolonged segments and filled pauses. A research was conducted that compared 100 sentences provided by speakers of northern Spanish dialects with 100 sentences from informants from southern Spain. In both corpora the same methodology was applied, a three-phase prosodic analysis of speech proposed by Cantero (2019), in order to compare the data objectively. According to my prediction, there will be significant differences in duration, as southern dialects will present relatively longer utterance-internal hesitations. This supposed difference is due to the fact that southern dialects are generally considered to be of higher speech rate (cf. Toledo, 2010) because of the frequent elision
of certain sounds (such as the syllable-final -s or the intervocalic -d-), and this phenomenon causes that the absolute duration of the syllables is shorter. This also means that lengthenings and filled pauses in the southern dialects, of the same assumed absolute duration as in the northern dialects, are relatively longer as compared to the length of previous segments.

Based on what has been revealed so far, this study focuses on hesitation phenomena from the point of view of duration, by formulating the following hypothesis: in southern Spanish dialects, as they are regarded to be of higher speech rate, the relative duration of lengthenings and filled pauses with no specific communicative functions is longer as compared to their context than in northern Spanish dialects.

2. Corpus and informants

The corpus was obtained from two sources: the ‘Map Task’ activities in the interactive Atlas of Romance intonation compiled by Prieto et al. (2010-2014), and of spontaneous interviews uploaded to YouTube. This way only spontaneous speech samples were obtained. 32 speakers were selected, 16 informants from the north (8 men and 8 women), and 16 from the south of Spain (also 8 men and 8 women), from recordings of 291 minutes and 30 seconds in total. In the northern corpus, 146 hesitation phenomena have been detected, compared to the 136 cases in the southern corpus. The following table sums up the data related to the informants.

<table>
<thead>
<tr>
<th>Northern Spanish corpus</th>
<th>speakers</th>
<th>monograph and code</th>
<th>job</th>
<th>sex</th>
<th>age</th>
<th>n° of utterances selected</th>
<th>duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gijón (Map Task)</td>
<td>Speaker 1</td>
<td>GP; EGI-1</td>
<td>student</td>
<td>f</td>
<td>24</td>
<td>5</td>
<td>5:49'</td>
</tr>
<tr>
<td></td>
<td>Speaker 2</td>
<td>AL; EGI-2</td>
<td>student</td>
<td>f</td>
<td>22</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Oviedo (Map Task)</td>
<td>Speaker 1</td>
<td>GP; EOV-1</td>
<td>student</td>
<td>f</td>
<td>20</td>
<td>9</td>
<td>4:52'</td>
</tr>
<tr>
<td></td>
<td>Speaker 2</td>
<td>MR; EOV-2</td>
<td>student</td>
<td>f</td>
<td>25</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Cabezón de la Sal (Map Task)</td>
<td>Speaker 1</td>
<td>NEO; ECA-1</td>
<td>teacher</td>
<td>f</td>
<td>31</td>
<td>12</td>
<td>11:50'</td>
</tr>
<tr>
<td></td>
<td>Speaker 2</td>
<td>AOZ; ECA-2</td>
<td>teacher</td>
<td>f</td>
<td>31</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Location</td>
<td>Speaker 1</td>
<td>Speaker 2</td>
<td>age (years; mean)</td>
<td>utterances (total)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Madrid (Map Task)</td>
<td>CTN; EMA-1</td>
<td>SBL; EMA-2</td>
<td>40,63</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salamanca (interviews)</td>
<td>FI; ESA-1</td>
<td>CG; ESA-2</td>
<td>40,88</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Burgos (interviews)</td>
<td>JV; EBU-1</td>
<td>LT; EBU-2</td>
<td>40,88</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ávila (interviews)</td>
<td>ÁA; EAV-1</td>
<td>M Á G N ; EAV-2</td>
<td>40,88</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>León (interviews)</td>
<td>AS; ELE-1</td>
<td>JADD; ELE-2</td>
<td>40,88</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canary Islands (Map Task)</td>
<td>AAG; ECAN-1</td>
<td>AAH; ECAN-2</td>
<td>40,88</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jaén (Map Task)</td>
<td>SB; EJA-1</td>
<td>DG; EJA-2</td>
<td>40,88</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constantina (Map Task)</td>
<td>LSN; ECO-1</td>
<td>MSC; ECO-2</td>
<td>40,88</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jerez de la Frontera (Map Task)</td>
<td>MGA; EJE-1</td>
<td>PM; EJE-2</td>
<td>40,88</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Málaga (interviews)</td>
<td>MÁJ; EMAL-1</td>
<td>EB; EMAL-2</td>
<td>40,88</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sevilla (interviews)</td>
<td>PP; ESE-1</td>
<td>JE; ESE-2</td>
<td>40,88</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Badajoz (interviews)</td>
<td>FJF; EBA-1</td>
<td>GFV; EBA-2</td>
<td>40,88</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Granada (interviews)</td>
<td>MJLG; EGR-1</td>
<td>LGCH; EGR-2</td>
<td>40,88</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The following map presents the regions of the corpora. Only monolingual areas were chosen for the analysis (leaving apart thus, territories such as Catalonia, Valencia or the Balearic Islands (partly Catalan-speaking zones), Galicia (partly a Galician-speaking zone), the Basque Country and La Rioja (partly Basque-speaking zones), because these regions could have shown influences by other peninsular languages.

Figure 1 - The origin of the informants.

3. Method

The theoretical background used in this work is based on the protocol for Prosodic Analysis of Speech, (abbreviated as PAS, Cantero, 2019). Pitch, duration and intensity are considered to be suprasegmental features, and due to this reason, they are relatively difficult to interpret. First, because we must disregard speaker-dependent characteristics that carry no linguistic significance, and second, because prosodic units must be understood as
bearing relative prominence only with respect to adjacent units, so they have no information alone.

A solution to overcome these difficulties is offered by Cantero’s Melodic Analysis of Speech (MAS) (2009) and his latter implementation to the theory, Prosodic Analysis of Speech (PAS) (2019). As for the analysis, there is an acoustic phase, assisted by an acoustic analysis software such as Praat (Boersma & Weenink, 2019). The second step is the prosodic representation: in order to concentrate only on the prosodically relevant features, it is necessary to ignore irrelevant variations and reduce the data in case of each syllable to a characteristic prosodic value (in case of intonation, in Hz; in case of intensity, in dB, and in the case of duration, in seconds). The third step is the data standardization: the prosodic data curves are represented taking into account not the absolute values, but the relative ones, as each syllable is given a percentage based on its prosodic rise/fall experienced with respect to the previous syllable.

This analysis permits us to describe more objectively the prosodic features of a given language, and compare prosodically, for instance, dialects. The process is illustrated in the next section, using examples from my corpora.

3.1 The standardization of prosodic data in the PAS model

The standardization of prosodic data is not a recent idea in linguistic research. Standardization of melodic contours was first done using semitones in the ‘Dutch School’, also known as the IPO model. The most emblematic work of this approach is ‘t Hart et al. (1990), followed later by various researches in different languages (Adriaens, 1991; Beaugendre, 1994; Odé & van Heuven, 1994). In Spanish, Garrido (1991, 1996) and Estruch et al. (2007) worked with similar automatic stylization methods (Baditzné, 2012).

The difference between the standardized curves in the PAS model and the ones in the Dutch School is that the PAS model uses percentages for the standard values, which is a system easier to handle than the one with semitones. The standardized contour is represented by a line which starts at an arbitrary value of 100% and anchors in each syllable, which is itself characterized by a percentage based on its tonal position as compared to the previous syllable. If the syllable is located lower, it is a negative percentage,
and if it is higher than the previous syllable, it is a positive one.

Though first applied to describe Spanish intonation (Cantero et al., 2005; Cantero & Font-Rotchés, 2007, 2020; Font-Rotchés & Mateo, 2011), it has been extended to the study of intonation in other languages as well, such as Catalan (Font-Rotchés, 2007; 2008; 2009), Chinese (Kao, 2011), and also in the description of the intonation of interlanguages, for example the Spanish spoken by Brazilians (Fonseca & Cantero, 2011), Italians (Devis, 2011), Swedes (Martorell, 2011) or Hungarians (Baditzné, 2011; 2012; 2018). For a partial Spanish application, cf. Patiño (2008). In Hungarian, a similar analysis was carried out in Olaszy & Koutny’s investigation, also based on percentages and standardized contours (Olaszy & Koutny, 2001: 182-183).

In the following sections I will explain how standardization works on durational data in the PAS model.

3.2 The steps of durational standardization

The first phase of the analysis is to identify syllables, and search for the intensity peak of each syllable. The following screenshot shows (with yellow continuous line) intensity values that accompany the utterance (the text is my addition). Every syllable usually has its intensity peak in the middle of its nuclear vowel, so these are the values we are searching for. The absolute duration of each syllable is calculated based on the distance between its intensity peak and the intensity peak of next syllable.

Figure 2 - The distance between the intensity peaks of the first two syllables of the utterance y tengo que ir a la Tienda Nueva Moda ‘and I have to go to the shop called New Fashion’, from Madrid (in seconds, indicated by the red arrow).
We can see that the first value we need is 0.26s, whereas the next distance, between syllables ten- y –go, is of 0.1s, which means that the duration of ten- is -61.54% shorter than the duration of the previous syllable y.

We could simply compare the duration of each syllable instead of comparing the duration of distances between intensity peaks; the argument supporting this latter view is that in Spanish, it is definitely difficult to separate syllables clearly, as the exact location of syllable boundaries is not obvious (Cantero, p.c., 2019). This is why it is preferred to measure distances between intensity peaks, as such peaks are easily recognizable acoustically as compared to the exact extension of a syllable.

The distance between the intensity peaks of the following syllables is calculated the same way, and as we can see in Figure 3, where all the intervals are displayed, there is a strikingly high value of 0.71s of the preposition a (‘to’), which is by far the longest segment of the utterance. The last value is calculated from the last intensity peak of the last syllable –da till the end of the utterance.

Figure 3 - Absolute duration intervals of the syllables in the utterance y tengo que ir a la Tienda Nueva Moda ‘and I have to go to the shop called New Fashion’, from Madrid

The next step in the PAS methodology is to standardize the measured absolute values by converting them to percentages with respect to the value of the previous syllable. In case of utterance-first syllables, this distance is added the arbitrary value of 100%, but the next values are calculated as compared to the previous one, so the percentage of the second syllable ten- is of -61.54%, as the duration of 0.1s is a decrease of 61.54% as compared to the previous duration value 0.26s. Figure 4 shows the standardized values of all the syllables of the utterance in a plot.
3.3 The analysis of durational data in the present research

In accordance with my objectives, segments affected by hesitation phenomena (lengthenings and filled pauses) will be examined from a durational point of view, assuming that in southern dialects, relative durational data will be longer, as southern dialects are considered to be of higher speech rate due to the higher proportion of elision.

As in this study the focus is on prolongations and filled pauses as disfluency phenomena, first we must define which segments were considered as part of this group.

The first criterion to fulfil was, in case of lengthenings, that the segment should be prolonged. There are several ways to determine if a segment should be considered lengthened. Lengthening is detectable by ear, so Deme & Markó (2013) for instance based their judgement on perceptive tests: if a segment was recognized as lengthened by 6 out of 10 listeners (all linguists),
it was considered lengthened. My choice was to base this judgement on
durational data: as the minimum duration of filled pauses is considered to
be 0.2s by Goldman-Eisler, 1973 and Guaitella, 1996, cited by Blondet,
2001: 8, and filled pauses are generally longer in Spanish than lexical vowel
lengthenings (Villa et al., 2017: 167), I took 0.2s as the minimum value for
both lengthenings and filled pauses. The other criterion was that the segment
in question should be longer than the previous one.

As the study focuses on lengthenings as disfluency phenomena, we
must also take a look at two cases in which lengthening is a natural by-
product of certain conditions but does not serve as a tool to gain time, thus,
is definitely not a disfluency phenomenon, and exclude those samples from
our analysis. First, we must bear in mind that phrase-final lengthening is a
natural process in numerous languages, including Spanish (Gósy & Krepsz,
2018). Second, stressed syllabic position can also result in longer duration
in Spanish (Ortega-Llebaria, 2006), so stressed syllables were also discarded
from the analysis (lengthenings in Spanish mostly affect unstressed segments

In my analysis, I have worked with two values in case of each hesitation
phenomena: the relative duration data of segments affected by hesitation,
and also their absolute duration data. As we are analyzing relative prosodic
values, we cannot take into consideration either utterance-initial lengthening
or utterance-initial filled pauses when we measure the proportion of duration
change to the affected segment, as these values cannot be contrasted with
any previous value, so they cannot even be relativized. Thus, these hesitation
phenomena were discarded from the analysis.

Based on what has been just said, only the following hesitation
phenomena were analysed in this study:

- lengthenings on unstressed syllables with duration superior to 0.2s,
  which are neither utterance-initial nor utterance-final;
- filled pauses with duration superior to 0.2s, which are neither
  utterance-initial nor utterance-final.
4. Results

In the following section we will focus on the analysis of the received data in order to validate my hypothesis, i.e. that the absolute duration of the examined hesitation phenomena (lengthenings and filled pauses with no specific communicative meaning) is coincident in northern and southern Spanish dialects, but the relative duration of the examined hesitation phenomena is longer in southern Spanish dialects than in the northern ones, due to the shorter syllabic intervals in the southern dialects.

Table 2 sums up the durational data related to the two hesitation phenomena attested in both corpora. As can be seen, in the northern corpus 146 cases were detected as compared to the 136 cases in the southern corpus. However, as utterance-initial and utterance-final hesitation phenomena, as well as lengthenings on stressed syllables, were excluded from the analysis, this number was reduced to 106 northern cases and 117 southern ones.

Table 2 - Data related to the tonal movements of hesitation phenomena

<table>
<thead>
<tr>
<th></th>
<th>North</th>
<th>South</th>
</tr>
</thead>
<tbody>
<tr>
<td>no of hesitation phenomena attested</td>
<td>146</td>
<td>136</td>
</tr>
<tr>
<td>no of non-initial hesitation phenomena</td>
<td>106</td>
<td>117</td>
</tr>
<tr>
<td>lowest value of absolute duration (s)</td>
<td>0,2</td>
<td>0,2</td>
</tr>
<tr>
<td>highest value of absolute duration (s)</td>
<td>1,25</td>
<td>0,77</td>
</tr>
<tr>
<td>mean value of absolute duration (s)</td>
<td>0,39</td>
<td>0,34</td>
</tr>
<tr>
<td>results of two-sample t-test (unequal variances)</td>
<td>t Stat: 2,04 &gt; t Critical two-tail: 1,97; different means</td>
<td></td>
</tr>
<tr>
<td>lowest value of relative duration (%)</td>
<td>4,76</td>
<td>5,26</td>
</tr>
<tr>
<td>highest value of relative duration (%)</td>
<td>675</td>
<td>540</td>
</tr>
<tr>
<td>mean value of relative duration (%)</td>
<td>161</td>
<td>153</td>
</tr>
<tr>
<td>results of two-sample t-test (equal variances)</td>
<td>t Stat: -0,5 &lt; t Critical two-tail: 1,97; same means</td>
<td></td>
</tr>
</tbody>
</table>

As attested in the results, the average value of the absolute duration data, in case of the northern dialects, is 0,39s, while in the case of the southern ones, it is 0,34s (cf. Figure 6), and according to the two-sample two-tailed t-test of unequal variances, this is a statistically significant difference, we cannot consider them the same.
In the case of the proportion of relative duration of the affected segments, the mean value is 161% in case of the northern dialects and 153% in case of the southern ones (cf. Figure 7), but according to the two-sample two-tailed t-test of equal variances, it is not a statistically significant difference.

Figure 6 - Absolute duration data (in sec) in the two corpora (lengthening and filled pauses; boxplots and statistical analysis are generated by Excel 365 pro plus).

Figure 7 - Relative duration data in % in the two corpora (lengthening and filled pauses; boxplots and statistical analysis are generated by Excel 365 pro plus).
5. Discussion and conclusion

In this study the two main dialectal areas of European Spanish were examined from the point of view of the durational aspect of two hesitation phenomena, lengthenings and filled pauses, when they lack any specific communicative function. A corpus of 200 utterances (100 northern Spanish and 100 southern Spanish ones, taken from Map Task activities and spontaneous interviews downloaded from YouTube videos) were contrasted, in order to verify the following hypothesis:

In both dialects, the absolute duration of segments affected by neutral hesitation phenomena (lengthenings and filled pauses with no specific communicative meaning) is the same, but in southern dialects, which are assumed to be of higher speech rate due to elision, relative values of hesitated segments will be longer, as they are compared to shorter previous intervals.

There is an argument to suppose that southern dialects present relatively longer hesitation phenomena in utterance-internal segments than their northern counterparts. This could be so because the southern variants are characterized by elision more frequently than the northern ones, thus, even if segments affected by hesitation are of the same absolute duration in both dialects, they are perceived relatively longer in the southern dialects where syllables are realized shorter due to elision than in the northern dialectal zone.

We have seen based on our results that the average absolute duration of hesitation segments, contrarily to the prediction, is lower in southern dialects: 0.34s as compared to the northern mean of 0.39s, which is a statistically significant difference. This means that the first part of our hypothesis – i.e. that absolute duration data of hesitation segments in both dialects will coincide – is not verified. As for the second part of the hypothesis, according to which relative duration data of hesitation segments will be longer in southern dialects, it again has proved to be false: the 153% of the southern mean as compared to the northern mean of 161% after statistical testing has turned out to be not significantly different.

This means that, contrarily to what has been predicted, southern dialects are characterized by higher velocity also in case of hesitation phenomena (lengthenings and filled pauses), and this is why we find no differences in the relative durational data. Northern Spanish speakers are characterized by
slower speech rate, and slower hesitation phenomena, whereas Southern Spanish speakers do not only present higher speech rate, but also the velocity of their hesitation phenomena is higher. In other words, the speakers of both dialects of Spanish tend to adjust the velocity of hesitation phenomena to their velocity of speech; the velocity of hesitation phenomena is also determined by the dialect of the speaker.

In this paper we have only seen the durational aspect of utterance-internal hesitation phenomena in European Spanish dialects, but by Cantero’s (2019) extended Prosodic Analysis of Speech (PAS) model we could define prosodic features other than duration in case of hesitation phenomena. The PAS model offers a standardization protocol for intonation and intensity similar to the procedure we have seen in the case of duration; as for intensity, the standardized intensity curve is generated by reducing every syllable to its prominent intensity peak value, and these values are standardized in terms of proportion always compared to the previous value. Melodic standardization calculates the tonal difference in terms of percentages for each segment, always comparing syllables to the previous ones, and thus the standardized curve is generated over these values. The perception threshold is already established for intonation: the Spanish ear is sensitive to at least 10% of tonal difference (Font-Rotchés& Mateo, 2011). These values are not yet discovered for neither intensity nor duration in case of Spanish, and, especially in duration, they would be essential for objective data interpretation.

Perceptive thresholds are important in duration, but it is also a question whether the human mind finds a segment lengthened comparing it to the duration of the adjacent previous segment; if this is the case, Cantero’s (2019) duration standardization model would be useful, but if our mind stores “average durations” of various previous syllables and compares the duration of every new segment to this stored average value, the PAS model would be insufficient to describe relative durations.

There are some special cases in which the PAS analysis may not calculate correctly the relative duration values if we do take into consideration some elemental rules. The position of intensity peaks is a crucial point in this analysis. When there are two peaks in a syllable, as in –o in Figure 8, it is the higher one which counts.
Figure 8 - Two intensity peaks in one syllable in *y que el río* ‘and that the river’, an utterance from Badajoz.

We must bear in mind that it is only an intensity peak which is located within a vowel which must be taken into account. Consonantal peaks (as in Figure 9) should not be taken into consideration. There are apparently two peaks in the same syllable, *ban-* in Figure 8, but the higher one should be taken, in this case, 67dB, as this peak is located on the vowel.

Figure 9 - Two intensity peaks in one syllable in the utterance *entre el banco* (…) ‘between the bank’, from Madrid, the second peaks is on a consonant, [n].
In some cases, the intensity peak is not located in the middle of the nuclear vowel. These cases suppose a challenge in the method, as they may cause that the relative duration of a syllable is predicted incorrectly, as in Figures 10 and 11. In Figure 10, it is clear that the two peaks that we must take into consideration are the ones with 71dB and 75dB, the first one is located before the middle point of the syllable -mien-, whereas the second is located towards the end of syllable –to, not in the middle.

Figure 10 - Some intensity peaks are not located in the middle of the nuclear vowel in y delayuntamiento ‘and from the city council’, an utterance from Madrid.

This is problematic because this way we have the following two absolute distances between intensity peaks: 0.38s and 0.15s, respectively. After standardization, it would turn out that the relative duration corresponding to the final syllable –to is 60.53% less than the previous value. This is definitely not the case if we look at the absolute duration of the syllables (not the distances), illustrated on Figure 11: the syllable –mien- has the duration of 0.29s as compared to the following syllable –to, with 0.34s. The relative duration data in this case would be of a 17.24%, a positive value instead of the negative one we got by the PAS analysis.
This means that if intensity peaks are not located exactly where they should (i.e. in nucleus-central position), the PAS model could predict relative duration data incorrectly. The lack of an easily discernible intensity peak would also result in difficulties (such as in case of intensity plateaus instead of peaks), as in this case taking the intensity value at the middle point of the syllable for example would be an arbitrary solution. The opposite case – the presence of multiple intensity peaks of the same or of almost the same value within the vowel would also raise the question of correct interpretation: which peak should be measured? Taking into consideration all these difficulties related to uncommon intensity peaks, measuring durational data between syllable boundaries instead of the distance between intensity peaks still might be a solution with less complications.

Another problem is related to the case when we have two, very short syllables, the second one being even the double of the duration of the first one, but still very short (cf. Figure 12).
Figure 12 - Short syllabic intervals in *y que el río* ‘and that the river’, an utterance from Badajoz.

In these cases, the model predicts that there is a lengthening (as there is a +50% of lengthening between the two syllables, but the distances are very short, only 0,1s and 0,15s). For this reason, based on perceptive tests a threshold value for minimal lengthening should be established (which might turn to be coincident with the value we applied in this study based on previous literature) and this threshold value could be a complementary solution to the model.

Finally, as for future research, there are numerous aspects that could be investigated apart from carrying out the same investigation on a more extended corpus, such as the comparison of durational data in hesitations between European Spanish and LatinAmerican dialects (the latter ones considered to be slower, for example the Mexican or Argentinian ones, which might again trigger the prediction of different relative durational values in hesitation segments).
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